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Greasing the Lower Tumbler of a Gold Dredge

Give the Young Men a Break

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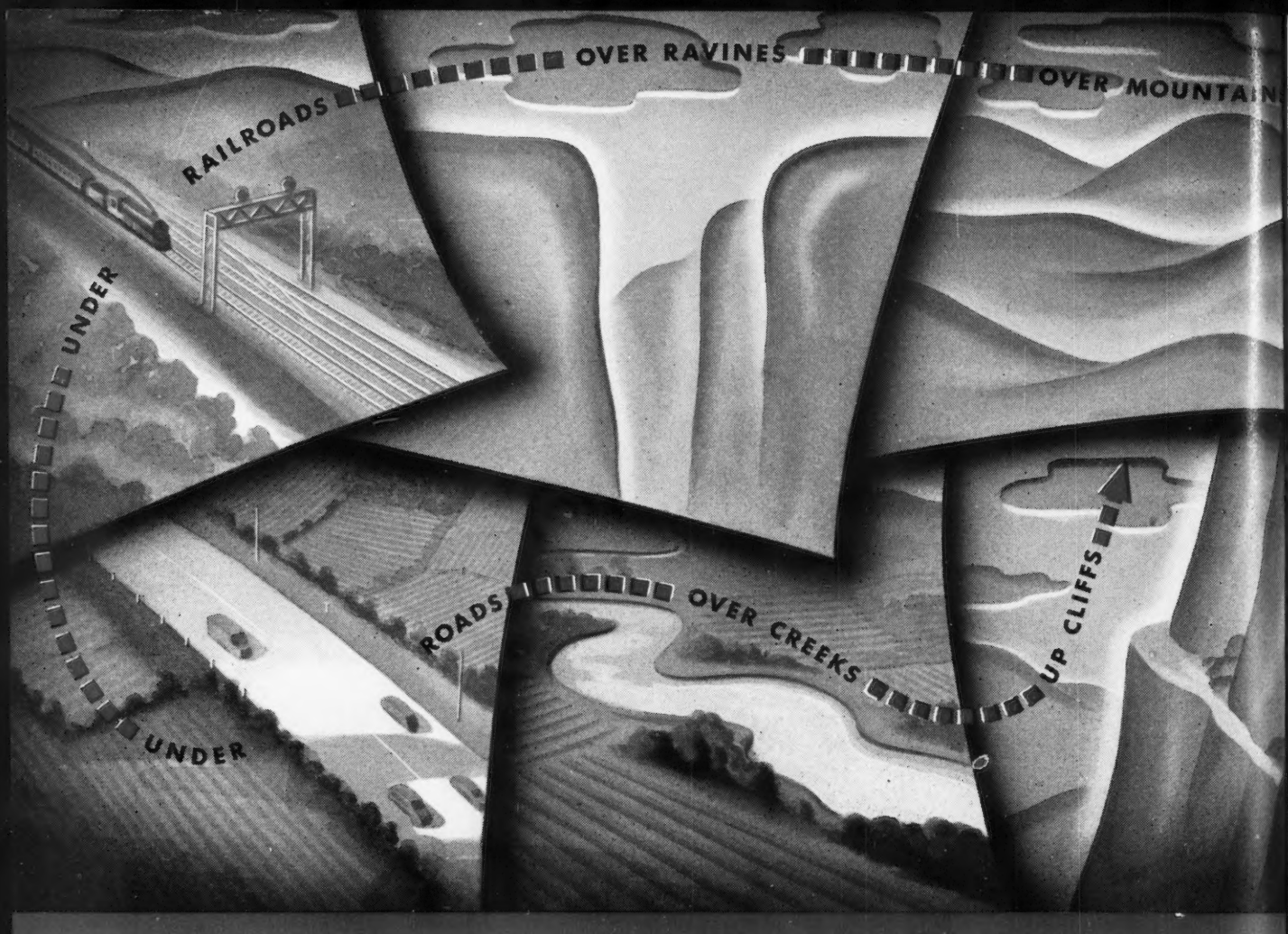

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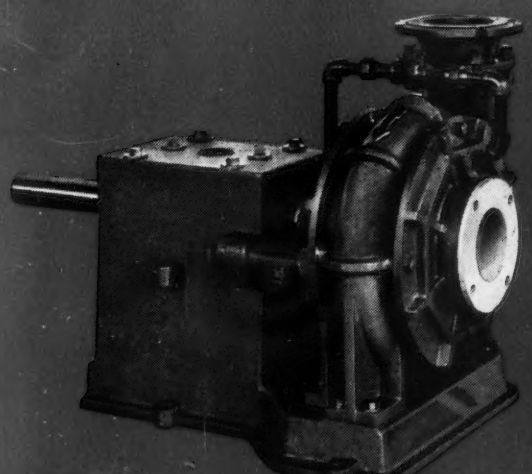

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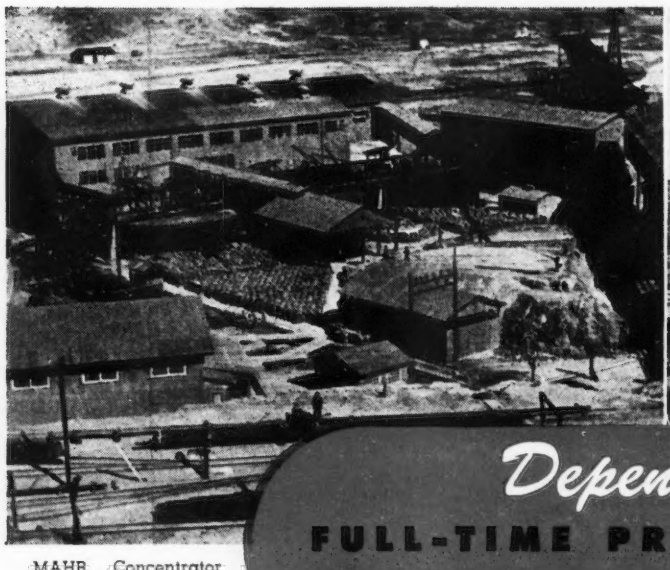

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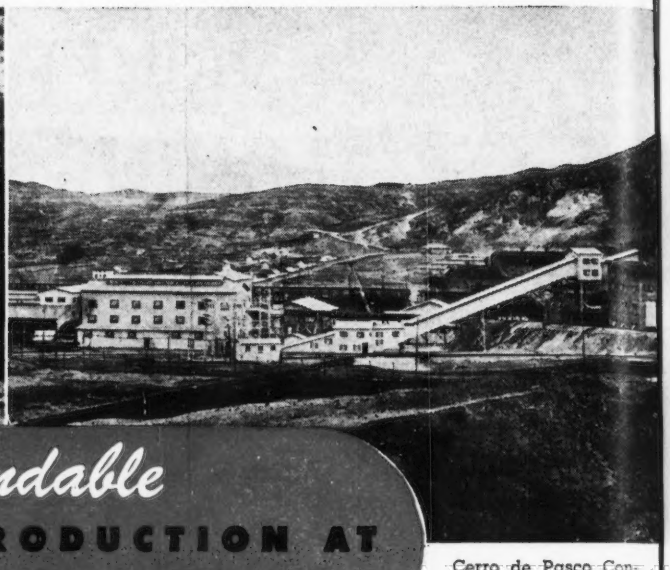

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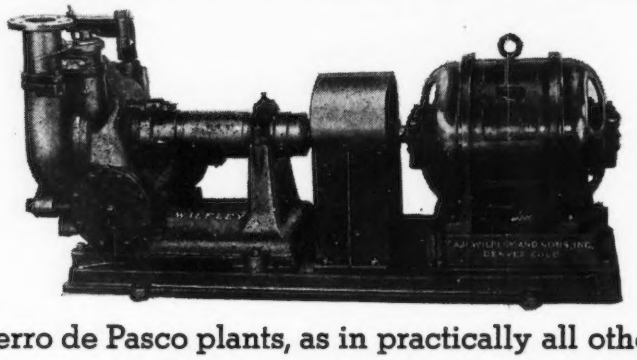

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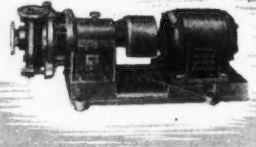

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CONTROLLED ATOMS or CONTROLLED LIVES

SINCE August 6th when the first atomic bomb was released over Hiroshima, the American people have been subjected to a continuous barrage of pronouncements on the use and control of atomic energy. Some of this comment has been strident, and much of it conflicting. A considerable portion of it has been of sincere and constructive excellence.

It has not been easy to separate the wise counsel from the merely noisy, and it is small wonder that the minds of many are troubled and confused.

However, the sheer mass of discussion poured into press and microphone has awakened us all to the gravity of the issue. In terms of any problem on which Americans ever have been called to exercise a judgment—This is It!

Even the dullest now recognizes that atomic weapons hang over modern civilization like the Sword of Damocles, and understands in some measure how fragile and taut is the hair of political balance that holds it suspended.

From this point on, we need the coolest and most carefully considered judgment that can be brought to bear. Discussion highly charged with emotionalism will but increase the tensions both at home and abroad, and render wholly insoluble a delicately intricate problem.

What Is The Problem?

The major outlines of that problem now are coming into focus in understandable terms:

1. The scientists have opened up a new and virtually unlimited storehouse of energy, and the engineers have discovered how to turn it into a military explosive incomparably more powerful than any we have known. We know that this energy may also be used to produce heat for useful power, and we suspect that the radioactive substances produced by the process in hitherto unimagined quantity may also have medical, industrial, and other constructive applications.

2. Terrifying as have been the demonstrations of the atomic bomb thus far, we know that they are as nothing in comparison with its potential destructiveness. The explosive force of individual bombs can be increased tremendously, and means for their effective delivery to predetermined targets in wholesale quantity already are at hand. The experts tell us that no practicable means of interception can be devised, and that reprisal in kind probably will be the only answer to an enemy attack with atomic weapons.

3. So far as we can see now, even successful retaliation would be at best an answer of hollow effect. Any two nations each having wholesale stock-piles of bombs could accomplish the practical destruction of each other. Since a first treacherous blow might well constitute an enormous advantage, a nation actuated by a ruthless urge to conquest or revenge might have the best chance of survival. But since the widest possible dispersal of bombs and launching units would be dictated by the strategy of atomic weapons, it is doubtful that one nation could destroy another without itself suffering destruction. On both sides the major centers of population could be wiped out, and the nation of least concentrated industrialization and commerce would suffer least. However, no one can be sure that the concentrated explosion of as many as 20 thousand atomic bombs would not poison the atmosphere of the world to an extent that would be fatal to great masses of population, not only within the country bombarded, but perhaps in the country which launched them.

4. The problem is further complicated because, so far as we know now, any large-scale commercial use of atomic energy as a power source is more or less inextricably linked to a potential military use. It is true that, if atomic power becomes economically feasible (which is by no means certain for a long time to come), it would require only low-grade concentrates of fissionable material, which would need further elaborate and costly processing before reaching explosive potential. But the process of producing such low-grade concentrates constitutes perhaps two-thirds of the industrial effort required to make effective bombs. It follows, then, that if nations were to equip themselves to produce large quantities of low-grade concentrates for power generation, the effort required to develop large-scale bomb production would be materially reduced. Moreover, the maintenance of an effective inspection to police agreements not to produce bombs might be forbiddingly difficult if atomic power generation were allowed.

5. In addition to the major problem posed by the use of atomic bombs in international war, any nation which produces or possesses such bombs, or the fissionable materials with which they are loaded, faces still another in the danger of their falling under the control of paranoid elements in its own population.

What Are We Going To Do About It?

We face the hard fact that we have produced a weapon capable of destroying whole nations—perhaps even the whole world. Although we were importantly aided in its development by the nationals of other countries, we, together with Great Britain and Canada, now must take the initiative in deciding what shall be done with it. We have only two choices. We can try to keep this weapon as a monopoly of our own, or we can try to place it under broad international control.

Can We Keep It To Ourselves?

If we know one certain fact about the atomic bomb, it is that it cannot long be held as a monopoly of those nations which produced it.

If Nazi Germany had succeeded in developing the weapon first, it probably would have attempted to achieve world dominion, with utter destruction as an alternative. Such a course is not within our range of choice. It violates every principle for which we stand.

Much reckless nonsense has been uttered concerning the inability of other nations to master the scientific, engineering, and industrial problems involved. It is the virtually unanimous opinion of those who worked on the project that several nations today are fully equipped in science, engineering, and industrial organization to produce atomic bombs and to provide the means for launching them. At least one of these nations, Russia, has also access to an ample supply of the necessary raw materials. The only debate is over whether it would take three, or five, or ten years for her to marshal her resources to produce bombs in multiple thousands. Once such an atomic race were on, we have no reason to believe that Russia might not divert more resources to the task than we ourselves should be willing to put into it.

Additional nonsense is talked as to how we might attempt to cope with the problem of living in a world in which mutually suspicious or hostile nations faced each other, with stores of atomic weapons on both sides. We hear talk of dispersing our cities and even of moving underground. No one has seriously reckoned the difficulty or the cost of following such counsel of despair. Still less has anyone appraised the neurotic effect upon men's minds of living by any such preposterous formula, under continuously mounting tension day after day, and year after year.

Certainly, if we could find no way to prevent the competitive production of atomic weapons, we should be driven at least to the selective dispersion of our bomb-launching facilities, of certain key industrial establishments, and of our centers of government and governing personnel. We should be forced, also, to change our traditional requirement that only Congress can commit us to active war. We should be forced to organize ourselves as a police or military state, with our scientists regimented and muzzled, with all of us under constant surveillance against the smuggling and planting of time-bombs, and constantly alerted against attack through the air.

Before we commit ourselves to any such intolerable procedure, we should be mad not to explore all possible means for making it unnecessary.

The Only Feasible Alternative Is Effective International Control

This cardinal principle has been recognized in the statement of November 15th, issued jointly by President Truman, and Prime Ministers Attlee and King. Their statement frankly concedes that against atomic weapons there can be no adequate military defense, that no nation can command a monopoly of such weapons, that responsibility for eliminating atomic energy as an instrument of war and for devising safeguards over its use for the advancement of science and other peaceful and humanitarian ends rests upon the civilized nations of the world.

They propose that a commission be set up at once under the United Nations Organization to make recommendations: (a) for extending between all nations the exchange of basic scientific information for peaceful ends, (b) for control of atomic energy to the extent necessary to ensure its use only for peaceful purposes, (c) for the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction, and (d) for effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions.

Already criticism is leveled at the wording of the statement, at alleged omissions, at the wisdom of choosing the United Nations Organization as the medium through which to seek agreement in view of the weaknesses of the UNO Charter.

None of these issues should be crucially important. What matters is that an invitation has been issued in good faith for the nations of the world to meet and decide upon means for assuring the elimination of weapons, the existence of which no one can afford to tolerate.

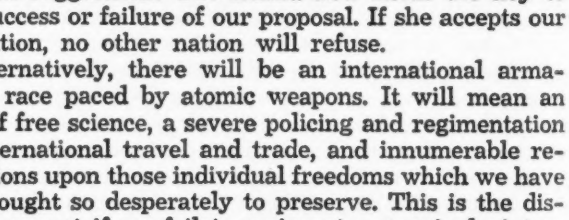
The decision cannot be other than international; it will require the best thought of the best brains the world can muster. The smaller nations have an equal stake with the large, and from them may well come the most fruitful suggestions. But Russia now holds the key to the success or failure of our proposal. If she accepts our invitation, no other nation will refuse.

Alternatively, there will be an international armament race paced by atomic weapons. It will mean an end of free science, a severe policing and regimentation of international travel and trade, and innumerable restrictions upon those individual freedoms which we have just fought so desperately to preserve. This is the dismal prospect if we fail to arrive at a genuinely international accord on the control of atomic energy. But even this interval would promise to last only for an uneasy period, until someone started pressing the push-buttons on the panel-boards of extinction.

The only permanent solution lies in finding means to eliminate war itself. That we cannot hope to achieve overnight, but we can, and do hope that the nations will now agree to eliminate atomic weapons and their radioactive by-products as instruments of war.

If they do that, we can move forward more surely to the constructive development of the incalculably valuable resources that science has newly opened to our use. And, we can hope also for a progressive improvement in international understanding.

Unless the nations can reach agreement on this paramount issue of atomic energy, it is difficult to conceive of any vital issue on which they might agree.



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December, 1945

Save Our Marginal Minerals

THE TIME HAS COME when the country must decide what to do about mineral deposits whose contribution to the economy will cease as peacetime conditions are restored, if special assistance is not given.

In the field of mining, most of the strategic and critical mineral producers have already absorbed a hard right to the chin since Metals Reserve stopped paying high prices for their production and Reconstruction Finance Corporation has tightened its policies toward mine loans. Now, with the end of the Premium-Quota plan for copper, lead, and zinc looming up on June 30 next, a much more extensive group of operations is facing a let-down. To the lower-cost producers of these metals this is not a serious outlook. Barring more tariff cuts, copper and lead prices are expected to rise when ceilings are removed. Zinc prices are not expected to drop very far and may hold or rise also. The low-cost producers have been getting the short end on premiums, and their position may actually improve when ceilings and premiums are both removed.

However, to the high-cost producers the outlook is more serious. They have been getting the long end of premiums, and cannot expect prices that will compensate for the loss of premiums. According to the nature of their operations, they will have to curtail or shut down.

In many cases this will be simply a private or local hardship. However, there are others where the national public interest may suffer from abandonment, simply because abandonment would cause loss of the resource or greatly increase the cost of its eventual utilization. No nation has such a superabundance of minerals that it can afford to waste them.

We are disturbed by the apparent acceptance in Government circles of two ideas: first, that we have become relatively poor in mineral resources and, second, that true conservation of minerals consists of locking up the resources and discouraging the industrial activity which brings them to market. Too many people fail to realize that the world outside the United States is in general not much better off for minerals than we are, particularly if it moves in the direction of a mass-production economy. Too many oversimplify the problem of mineral conservation. They fail to realize that there is more chance of enlarging mineral supplies in the future by technological progress than by surface discoveries. Adequate technological progress, either geological or productive, is not likely to be made without "going" industries operating under competitive conditions.

Probably the most conspicuous case now at hand where it ought to be considered if the public interest would be served by extending special assistance is the famous Tri-State zinc-lead district of Oklahoma, Kansas, and Missouri. This area, which during the twenties furnished about half the nation's zinc supply and since has furnished about one-third, seems destined for a virtual collapse when premiums are removed. The drain on its reserves under the spur of wartime demands and high premiums has been so extensive that only a minor fraction of the operations can face the future without above-the-market assistance. In September of this year the district produced 10,155 tons of zinc and 2,107 tons of lead (metal content of concentrates) from ores averaging less than 2½ percent zinc and one-half percent lead content. Also it produced 1,917 tons of zinc (in concentrates) from the remilling of old tailings averaging about 0.7 percent zinc content. Despite the advanced depletion which these figures indicate, the district is estimated still to contain some 53,000,000 tons of ore averaging 2.5 percent zinc and 0.4 percent lead. From such a reserve some 875,000 tons of zinc and 140,000 tons of lead can be saved from ore which is currently being mined at an average price of $105 per zinc concentrate ton (corresponding to a metal price of 13.75c. per pound of metal, St. Louis). Now, while sizable operations exist, most of the enormous, interconnected underground workings are empty of water, the mine, transportation, and treatment facilities are at hand, and thousands of skilled workers are resident in the area. If these advantages are allowed to lapse, the cost at some future time of unwatering, of pollution, and of equipping and manning the operations would certainly be vastly greater than that of saving the resources while they are readily available. Also, a considerable

loss through oxidation and leaching would occur, and the products could certainly not be had on short notice.

Probably there are other areas which present similar problems. The Michigan copper country, for example, seems to be in jeopardy from the reduction of its premiums, and deserves study.

We believe that the national and world problem of minerals over the long pull is one of supply rather than oversupply. Therefore, we believe that the Government would be acting in the best interests of the nation by purchasing minerals while they are available, if abandonment is threatened and such abandonment would mean either condemnation of the resource or a much higher future cost of production. Minerals thus purchased should be put into the most storable form and placed in a national reserve against the day when the public interest would be served by committing them to use.

How About Staying Free?

ALTHOUGH neither management, labor, nor Government wants compulsory arbitration or any further encroachment of Government into the field of labor relations, there nevertheless appears to be a trend in that direction.

Labor leaders are conscious that any new legislation in the labor relations field is certain to clip their wings. They know that the tide of public sympathy is running out on them and that any further gains through legislation are bound to be balanced by new restraints. Therefore, their hearts were not in the recent conference, and their obstructionist tactics had much to do with its failure.

Management's representatives are similarly lukewarm about compulsory arbitration. They fear Government encroachment on any front. Also they realize that arbitration, as it has been practiced, always results in some gains for the opposition; that labor leaders can inch their way toward their objectives by constantly provoking disputes and calling for arbitration. Management's disposition is to limit arbitration to disputes over the meaning of contracts in force.

Many of our readers will be inclined to disbelieve our statement that Government wants to refrain from further invasion of the labor relations field. However, we can state with assurance that responsible leaders in both Administration and Congress are deeply worried over the drift toward state control and would welcome public support in curbing the trend. True, there are socialists, economic theorists, and opportunistic bureaucrats scattered through Government agencies who constantly bore from within toward more Government everywhere, but this element is not in command. Responsible officials are disappointed that management and labor do not give much more than lip service to free enterprise, and constantly seek to dump their joint problems in the lap of Government.

If management, labor, and Government don't want compulsory arbitration, whence the pressure? It comes from Mr. and Mrs. John Q. Public and their soldier sons. They are tired of strikes and delay in reconversion. They want new houses, cars, and clothes, washing machines, gadgets, and jobs for returning servicemen. They want to get this labor relations problem out of the way and move on toward higher standards of living, prevention of inflation and postwar depression, and control of the new horror which threatens all civilization. If management and labor can't settle their differences without disrupting the economy, the public does not stop to theorize about private enterprise versus authoritarianism; it goes straight to the point and says, "If they can't be good, compel them." The result is a flood of letters to Congress and the White House, a pressure which political leaders dare not ignore. Thus, we can expect a new set of compulsions, another step toward totalitarianism, if management and labor fail to do a better job of satisfying the public.

For our part, we are against compulsory arbitration or any other step toward totalitarianism. We think that labor unions must accept responsibility for their acts and commitments. We think the Wagner Act should be overhauled to give management the natural rights of free citizens and to discourage work stoppages over jurisdictional disputes. We think that management could do a much better job of earning the trust of its workmen, a trust which, by and large, it does not enjoy today. Labor and management should get their differences out of the newspapers, out of Washington, and back to the plant.

We recognize (E.&M.J., May, p. 75) that there is a world revolution in progress, a vast drive which cannot successfully be ignored, of common men everywhere toward a better life and greater participation in the fruits of their labor. The relatively limited objectives of American labor's part in this revolution should hearten those people who prefer courts to firing squads. Collective bargaining seems to be the only device available to meet this revolution within a democratic framework. To make collective bargaining work by voluntary cooperation between labor and management should be the sincere desire of every citizen who wants his children to inherit a democracy.

Committee Improves Stockpile Bill

ACTING QUICKLY after the brief hearings held over the Administration stockpile bill—with which we expressed dissatisfaction in our last issue—the Senate subcommittee chairmanned by Senator O'Mahoney wrote a new bill (p. 108). This was approved with minor changes by the full Committee on Military Affairs.

This bill (S.-752 revised) is more or less of a compromise between the earlier Thomas bill (S.-572) and the Administration proposal, the Johnson bill (S.-1481). Considering all the aspects of the stockpile problem which the subcommittee had to weigh, we believe that it did a good job.

In our opinion, the principal objectionable features in the Administration proposal were: (1) that the appointment of a chairman was left to the head of whatever Government agency the President should designate, thus making it possible for an ambitious department to make a political football of the stockpile program; and (2) that disposal of material declared no longer necessary for military security was too loosely safeguarded to protect the mining industry against possible bureaucratic persecution or ineptitude.

By putting the chairmanship appointment in the President's hands and subjecting it to Senate ratification, the Committee bill throws reasonable safeguards around the choice of a chairman and gives interested parties a chance to be heard. Also, the board's power to act, in pursuance of objectives laid down by the President, is vested in the chairman, thus reducing the departmental secretaries who are members of the board to an advisory status. Moreover, the bill provides "To the fullest extent practicable, the Chairman shall appoint industry advisory committees . . . to advise . . . with respect to the purchase, sale, care, and handling of such materials."

To safeguard disposal, the bill provides that six months' notice must be given to Congress and published in the Federal Register. Except for obsolescence, disposal can be made only with the express approval of Congress. Imported materials can be sold only at the market prices current at time of sale or at cost plus current import taxes.

The Johnson bill had provided for complete disregard of the "Buy American" Act. The Thomas bill provided for its observance "except where the Board determines that it would be inconsistent with the public interest." The Committee version is somewhat stronger than the Thomas bill in this respect. It provides for observance of the "Buy American" Act except where the chairman, with the advice of the members of the board, shall determine that the objectives of the policy statement of the stockpile bill cannot thereby be achieved.

The policy clause is as follows: "That the natural resources of the United States in certain strategic and critical materials being deficient or insufficiently developed to supply the industrial, military, and naval needs of the country for common defense, it is the policy of the Congress and the purpose and intent of this Act to provide for the acquisition and retention of stocks of these materials and to encourage the conservation and development of sources of these materials within the United States, and thereby decrease and prevent wherever possible a dangerous and costly dependence of the United States upon foreign nations for supplies of these materials in times of national emergency."

Power to determine what is appropriate for stockpiling, how much is to be acquired, the dates by which the acquisitions are to be consummated, and what materials are no longer required, is vested in the President, "with the advice of the Board."

We believe that the Committee bill deserves the whole-hearted support of the mining industry.

MILLING AROUND

Domestic producers of lead and zinc ought not to presume that they will escape new tariff cuts in the near future simply because they have already suffered reductions. There are signs that the State Department is sharpening its ax for them soon, as well as for the copper producers.

We are glad to see (p. 109) *bills introduced to end gold's absurd status as a contraband material. The present official policy toward gold could develop only if a government intends to pursue policies which undermine public confidence in the currency. To make gold contraband is anomalous in a democracy and is comparable to smashing the thermometer to correct the temperature.*

When British delegates seeking consideration of Britain's economic plight were perturbed by Henry Wallace's appearance of slumber during conferences, they were assured that this is simply Secretary Wallace's method of concentration. We certainly envy a man whose friends are so loyal!

??? Is The Mining

Give the Young Fellows a Better Break

AMONG THE LESSONS which have been demonstrated during the war, none is more evident than the capacity of young men to accomplish seeming impossibilities when given a real chance. It is already plain that some industries realize they have neglected a potent resource, by the steps they are taking to attract able young men into their folds. Will the mining industry stand idly by and watch others mine out the bonanza represented by the knowledge, ideas, and enthusiasm of our able young men?

To be perfectly frank, we believe that the mining industry is understaffed with able young men in influential and authoritative positions, and that if it understands its own best interests, it will take steps to lower the average age of its key personnel drastically.

Does this mean that we should turn the older men out to pasture and give the place over to the younger fellows? Certainly not. The older man has qualities that are fully as valuable as those of the younger, and not to be neglected by an industry devoted to extracting the most out of available resources. The point is that neither group can do as good a job as a properly balanced team, wherein each element has representation all along the line of authority and must be persuaded, rather than overridden, by the other.

The younger man, given a chance, can furnish new ideas, vigor, and enthusiasm. Knowing that his best years and opportunities are in the future, he is disposed to prepare for it. He will not accept the dictum that we have become a mineral have-not nation without risking more money in prospects and organizing research for better geophysical methods, extraction, and treatment. Believing that unions are here to stay, he is more disposed to learn how to turn them to constructive ends than to waste time in guerrilla warfare over a lost cause.

The older man, on the other hand, has a backlog of experience that should enable him to foresee consequences that younger men unassisted would have to discover the hard way. The mistakes he has made or seen make him cautious, and his direct experience in doing things is an invaluable asset. In facing the future, if on the one hand he is unaggressive toward meeting its problems, on the other he can lend objectivity—always a useful quality—to consideration of them.

Considering the pressure of labor relations, public relations, and the need for more attention to problems affecting our industry as a whole, management is understaffed anyway. At most operations management has been so overloaded that in recent years modernization of plant, management improvement, and straight production problems have suffered for lack of attention. In other words, there is room to inject new blood into management organizations without jeopardizing the welfare of older men.

To correct the situation calls for promotion of men under forty into key positions scattered all along the chain of technical and executive responsibility right up to the top. No link in this chain should be insulated from the energy and courage of young men or the caution and know-how of older men. To fail to sandwich these groups into an effective team is neglecting an available resource just as obviously as failing to exploit a pay streak in the ground.

Another angle is that some other industries have not failed to take heed of the progress made by industries which are heavily staffed with bright young men, such as electronics and aviation. To get their share they are offering training programs, choice of jobs, and attractive promotion opportunities. Although mining has established a good record of wage levels, it has never garnered the reputation of paying key men or young technical men well. If it fails to overtake this deficiency, it certainly will not attract a satisfactory share of the best brains coming up.

An efficient, loyal management personnel is the very lifeblood of any organization. Through collective bargaining, labor has been able to increase its participation in operating revenues. Granting these increases, most managements have given only lip service to the loyalty and value of supervisory, technical, and office personnel. This neglect exists, even though it is evident that labor will never permit the bulk of any so-called savings thus obtained to survive as profits. It is time to correct this situation, in order to preserve in the management organizations of our industry the ability, morale, and loyalty so essential to efficient operation.

The day is over when able young men who have spent time and money equipping themselves for the mining industry will go begging, as happened in the thirties. Now, because many of the products of that decade had a discouraging experience, and because of the disruption of higher education by the war, we have a disquieting insufficiency of young men acquiring mineral education. Against the competition of a growing array of technical opportunities, including chemical engineering, radio, electronics, and aviation, the mineral curricula are not going to obtain their share of outstanding candidates unless the mining industry does something to improve the vista which men in school see beyond graduation. If we improve the prospects for young men in the industry, enrollments in mineral education will automatically improve, both in quality and quantity. However, to assure a healthy situation, liaison between the industry and its schools can certainly be bettered, to mutual advantage. The schools would benefit, both in morale and in efficiency, if the industry would take more interest in their problems. The industry cannot help benefiting if the schools turn out better men.

In a nutshell, it's time the mining industry utilizes a resource it has been neglecting. Let's pay key men better and give the young fellows a better break.

Industry Neglecting:

1 **THE EDUCATION** of its future technical and supervisory talent, and fundamental research vital to its long-range interests?

2 **TO UTILIZE** effectively the knowledge, vision, courage and energy of young men, by failing to grant them opportunity and authority?

3 **TO COMPENSATE** adequately its supervisory and technical personnel, whose efficiency and loyalty are its most valuable asset?

4 **TO KEEP ALIVE** the stream of promotion so that competent, ambitious people will be contented with the outlook it offers?

BELIEVING, REGRETFULLY, that the answer to all the above questions is "Yes," *E.&M.J.* has undertaken to throw these subjects open for examination and discussion. Whether we are right or wrong is in itself of small consequence; however, if we *are* right, the mining industry* cannot afford to fail to correct the situation as soon as possible.

Thus, we planned a series of articles to develop the above topics. To start the ball rolling, we prepared an editorial statement, which is reproduced on the opposite page. This we submitted to mining educators all over the country, along with a questionnaire. The present article is the result. As future chapters in the symposium, we intend to develop the views of: (a) young men; (b) technical and supervisory men below general managers; and (c) general managers and higher executives. Lastly, we hope to publish a description of actual results where some of these ideas have been put into practice.

EVAN JUST
Editor

We suggest to mine managements that, with full attention to the enlarged scope of management responsibilities, they should decide how many new technical and supervisory men they will need in the next five years, then consider where these men are coming from. The war has been tough on key personnel; many older men have deferred retirement because of need for their services; probably retirement ages will tend to go down. On the other side, there is a real dearth of students preparing for geology, mining, or metallurgy in the schools; men returning from war seem to be looking elsewhere; and young men entering college are attracted to the new, "glamor" industries rather than to mining. All this adds up to a shortage of properly trained, able men for the needs of the mining industry. If action is not taken to change this outlook, mining will be at a disadvantage in filling its needs from improperly trained or less able men; in other words, from the overflow of other industries.

At this point we want to make it plain that we do not hold for setting up a hierarchy based on tech-

*In this discussion, and in general, we use the term "mining industry" to include ore dressing and smelting. Answers to our questionnaire indicated that many accept "mining" thus used in a more limited sense. Is there need for a redefinition of terms?

nical education. Mining, and all other industries, have always benefited from the talents and energy of men who lacked formal education, and we should hate to see the day when industry discourages the man who lacked advantages in his youth. Nevertheless, it is a certainty that *most* mining key men of the future will be technically trained. Thus, the mining schools are inevitably the principal seed-bed in which future key men of the industry will grow. Therefore, for the first chapter of this symposium, we turned to mining educators for their views.

We expected that a majority of mining educators would more or less concur with our views. Nevertheless, we were astonished at the overwhelming and emphatic corroboration which the gardeners of the seed-bed gave to the statement printed herewith. The sincerity of their position is unmistakable, and even people imbued with an opposite view could not fail to be impressed by the strength of the endorsement. These men are deeply worried over the mining industry's neglect, and unmistakably for the industry's sake, not their own.

If mining will accept the views of its educators, it is definitely not offering job and pay opportunities that provide real competition in bidding for the attention of able young men.

Is Mining Education Losing Out?

"There is at the present practically no volume of young men interested in pursuing mining engineering as a future profession."

"*The competition of other industries is practically squeezing out the demand for an education in the mining field.*"

"The whole metal and mining industry needs advertising or even dramatizing if that is possible. So many youngsters come to us who would make excellent material for the industry and yet have no idea what the words mean, let alone what the future holds. The fields of aviation, radar, and electronics in general are so glamorous today that other less spectacular fields are being sadly neglected by the younger generation. Anything that you could do to correct this situation even to a slight extent would be a genuine service both to the industry and to the boys."

"*We expect this 'pinch' to become more and more noticeable. The only people that can do anything about the situation are our mining friends. The business must be made more attractive for the young men if the industry is to hold its own—and it must.*"

"Although mucking in a mine may be the finest method of training a young engineer, it does not appeal to the high-school graduate as a desirable reward for four years of engineering study, especially if other lines of engineering graduates are offered much more desirable positions."

"*There is very evident an alarming lack of interest on the part of students in the mining engineering profession. I think part of it is due to the times. Men coming out of service and young men entering from the high schools have been hearing and experiencing so much in electrical communications, electronics, and power development that they are naturally turning to courses which will train them for professional work in those branches . . . Mining engineering ranks next to the bottom in enrollment in our ten technical curricula.*"

"The great activity in the many branches of the electric industry and the fascinating war accomplishments have stirred the imagination of the young men that previously had been attracted to the idea of the romance and adventure of mining. As an illustration of this competition, our best metallurgical graduate in 1944 had several offers from Western mining companies, but he accepted employment with the General Electric Company in the East as the best salary offer and promise for the future."

Not Meeting Competition

In the matter of starting salaries, opinion is about equally divided as to their adequacy. The principal fault seems to be that promotion after the first year or so is too slow. After they have served their apprenticeship, men waste what should be their best years in a long, disheartening wait for a chance to carry out their ideas, to have responsibility commensurate with their ability, and to enjoy adequate income; they are graybeards before they get this chance. This situation gets back to the schools, and too many ambitious young men decide to try their luck along other lines.

Also, many other industries offer either glamor and rapid growth or systematic, rounded training and choice of a specialty after training. All too often mining seems to cling with stupid tenacity to its hard-boiled tradition. The technical graduate, who has already spent four expensive years in preparation, is placed at the technician level in a laboratory or handed a muck stick, and, as far as he can tell, is forgotten. If he is not actually forgotten, the management keeps it a secret from him; or the primitive stuff lasts far beyond the point of being valuable to the trainee; he gets disgusted and discouraged—"Is this what I went to college for?"

Nobody seems to object to the tradition of seeing if the trainee can "take it and like it" when exposed to hard work, even though some point out that not every man who has technical or managerial ability will necessarily do well at hard labor. The objection is that generally the apprenticeship is primitive, too long, and not comprehensive; it wastes too much of a man's time and affords him no perspective of opportunity ahead.

We asked the educators if they were feeling the pinch of competi-

tion from new "glamor" or expanding industries and those which offer systematic training or maintain close relations with the schools. With few exceptions, the answer was emphatically "Yes."

The educational situation is typified in a statement published in the New York Times by Professor B. A. Thresher, of Massachusetts Institute of Technology. In analyzing the applications of 1,102 servicemen to enter M.I.T., he points out that only 12 want metallurgy, and very few want geology. (M.I.T. no longer offers a mining engineering curriculum, but from other evidence we can assure the reader that metallurgy, low as its position is, is more popular than mining engineering.) The emphasis is on electrical, mechanical, and aeronautical engineering. Also, although this analysis of serviceman applications does not reflect it, chemical engineering is attracting hosts of young men into its fold. Within the mineral group, the petroleum industry is well out ahead of mining, and coal mining seems to be the most laggard of all.

Mining Education Defective

The educators whom we questioned were not inclined to blame the industry for all their troubles. Many of them were quite frank in expressing their dissatisfaction with the conduct of mining education. Therefore, although our survey was not intended to develop a critique of mining education, it may be helpful to discuss a few of the points which cropped out in the survey.

The dissatisfaction of mining educators with the way the seedbed is being tended seems to be classifiable into two main categories. First, they think the conception that a mining engineer is a jack-of-all-trades is outworn, and that curricula should be revised to put more emphasis on special features peculiar to mining. Second, they think that as a result of the idea that mining and metallurgical engineering are nothing but the application of civil, mechanical, electrical, or chemical engineering to mining, the belief is too prevalent that an adequate mining or metallurgical engineer can be developed simply by giving some other kind of engineer a little experience in the industry. This tends to make students choose other lines in the belief that their opportunities will be wider and will include the mining

What Educators Say About Job Opportunities

"It has long been my opinion that the abilities and capacities of young men, both while they are in school and later when they enter the industry as junior engineers, are not fully recognized nor appreciated. The starting salary most often is too low, but what is more serious is that opportunities for these young men to test their abilities and to assume real responsibilities come too slow—often long after the man has passed his prime physically and intellectually."

"The mining industry should immediately take steps to set their house in order so that they do not lose the valuable young mining graduates that are now being discharged from the service and who will seek other fields unless they are assured of compensation comparable with other engineering fields, definite procedures for advancement, improved living facilities at the mines."

"Those companies who do not look forward to the future and give the young engineer a decent start in their organizations will be in a serious position as far as management is concerned some day in the not too distant future."

"The concept that a key man has to have years of experience as a driller and/or mucker must be revised considerably. Giving a young fellow such training for positions of responsibility in the industry is similar to training a son of Man o' War for the Kentucky Derby by having him pull a plow."

"As you recognize . . . the place where these young fellows get stymied is about ten years after graduation, and I don't know the answer to it."

"The worst thing that the mining companies do is to give the definite impression that they do not place much value in a young technical man. They seem to think his technical training of little value and consider 'practical experience' worth much more. This is ridiculous. Such an attitude places the mining industry in a 'horse-and-buggy' age."

"I cannot honestly recommend mining engineering on a competitive future income rating."

"What the industry is going to do in the next few years for well trained recruits in mining engineering, I do not know, unless something can be done to change the trend. I feel that the first question on your questionnaire indicates part of the answer; namely, that the mining industry is not affording adequate job and pay opportunities, and especially is not affording the young recruit the industrial training opportunities that are being offered in other branches of engineering. Some of the large electrical manufacturing companies, as you know, give a man a year or two-year course of training on pay after graduation, and give him every opportunity to find out by that method where he can best fit into the work. With few exceptions, the mining companies do not offer this type of opportunity."

"Management in the mineral industry is full of oldsters and youngsters are not encouraged to enter the field, lest no doubt these young men would bring in some new ideas that would disrupt the happy status quo."

Industry Needs Young Blood

"How many of our older men understand barodynamics, photoelastics, the principles of similitude, atomic energy, the numerous advances in thermodynamics, physics, chemistry, and mathematics, as they affect mine, smelter, and mill operation and the search for minerals? The fundamentals that most of our key men have a bowing acquaintance with, bear a relation to the fundamentals now available that a Model T Ford does to a Flying Fortress. Physics and chemistry concepts, the basis of the mining profession, are outdated every ten years.

"The new ideas are in the hands and minds of young men. They cannot be in the minds of the old. If the industry does not exert every effort to attract and encourage the visions, brains, knowledge, and enthusiasm of these men for the industry, it is falling down on the job."

"Too many organizations fail and go to seed because they do not appreciate the necessity of having young blood. The older members fail to realize that they are no longer young. Some of the most successful organizations of the country owe much of their success to their policy of fitting into the organization every year young technically trained graduates."

"I certainly am sympathetic with your idea that the bright young men of modern vintage ought to be pretty well infiltrated throughout these industries so as to occupy positions of importance all the way up the line."

field. Also, many engineers trained along other lines are trying to perform mining and metallurgical functions, with a consequent loss to the industry of the benefits of specialized training.

Liaison Urged

In short, the industry is already so complex that it not only has technical problems peculiar to itself, but within its framework has more specialties than one or two curricula can embrace. Any engineer who can run a transit is no longer suitably trained to tackle mine operation; geology is too complex to be a spare-time duty for mining engineers; and metallurgy has several separate branches, including ore dressing, pyrometallurgy, and electrometallurgy. To meet the problems of the future along all these fronts demands specialized knowledge in each if the industry is to make satisfactory progress in the future.

The mining educators are emphatic in the view that satisfactory training cannot be had in school alone, and that liaison between the mining industry and its schools is pitifully inadequate. To be sure, there are spots where nearby operations are helpful in providing summer employment and, in some cases, jobs after graduation, but this cooperation is by no means general or adequate. Usually, where proffered it is at the instigation of the student or the school. Many other industries have personnel men who visit the schools, contacting juniors and seniors, and offering summer employment, permanent jobs, and in many cases extensive systematic training with choice of a specialty after the training. The ambitious undergraduate who sees the men in other fields offered attractive opportunities and all the prospective graduates snapped up months before graduation, while mining or metallurgical engineers go begging, is quite likely to switch his curriculum. *E.&M.J.* emphatically believes that the mining industry cannot afford to be indifferent to this situation.

Not to stop with mere criticism of a bad condition, we asked the educators for their ideas on how to apply correctives. On this question also there was a high degree of unanimity, suggestions being offered along several lines.

The opinion was widespread that the job of correction begins at the high-school level. To most boys in their teens mining is merely a word. Because of the remoteness of most mining from population centers they have no contact with it; because it does not advertise any products or fill editorial columns with glamor stories, they have little chance to learn what it is all about. The "glamor" fields like electronics and aeronautics, or the industries whose products surround the younger generation and fill the advertising pages, like chemical, mechanical, and electrical manufacturing, have an inside track for attention.

Training Required

To overcome this situation, the educators suggest more missionary work in high schools. They urge mining men to take an interest in boys of high-school age, to talk to them both singly and from the platform, to tell them what mining does, the kind of life it offers, and the kind of individual who fits its environment. They suggest urging high-school teachers and principals to use films and exhibits which illustrate mining.

The most effective and convenient way in which industry management can cooperate to its own advantage with the schools is through apprentice training. Most educators believe that the big end of the school job is to deal with fundamentals, that the schooling period does not give them time to go deeply into applied science, and that the best place to learn applications is in industry anyway. They lean toward either of two types of apprentice training: (a) cooperative education, wherein the student takes a year or two longer to complete his studies and spends a considerable portion of his upper-class work in industry, usually rotating with one or two alternates; or (b) summer vacation work in industry, supplemented by a rounded industry training course after graduation. In both these types of training, the trainees should not be kept in any spot beyond the point where the experience ceases to benefit them; their experiences should be broad (possibly even beyond the purview of a single company), and they should be upgraded faster. They should get enough attention from the management to know that they are not forgotten, and to have a perspective of what lies ahead for them. They should be handled in a

way that makes it plain that the management does not consider their education a waste of time, and that the hard-labor or technician experience is not an end in itself.

There are many ways in which the industry can give important and needed financial aid to mining education, much of which will yield direct benefits and is therefore hardly classifiable as philanthropy. First, financial aid to students through cooperative or summer employment helps many who might otherwise be unable to finance their education. Second, the granting of scholarships will not only serve to sharpen the minds of prospective employees, but if properly conceived should be a means of solving some plant problems.

More important, the assignment and financing of research problems to schools not only provides a suitable method of solving difficulties, testing ideas, and making new discoveries, but enables the schools to have better teachers, better equipment, and to attract better students. In this connection, several educators expressed the view that mining is handicapped by a lack of sufficient fundamental research. Much of what has been done has been in the schools, which, by and large, have been inadequately financed to do justice to the efforts.

Inspiration Is Needed

But the job of helping the schools serve industry better cannot be done solely by writing checks. Obviously, the educators feel that most men in the industry have little interest in educational problems or in improving the products turned out. Teachers and students need more advice on how to meet the industry's needs, and more of the inspiration which springs from personal contact. Also, to meet competition for promising young men, mining companies must adopt a positive policy in making contacts and offering employment, not wait haphazardly for schools and individual students to apply for jobs.

Although mining today is not classed as a "glamor" industry, if managed with imagination and foresight it can develop sufficient movement and color to attract its share of able young men. It is within the power of the men who guide its affairs to invigorate it with progressive management and a ceaseless drive toward new frontiers in discovery, technology, and efficiency. If, on the other hand, they are contented to do things the way they were done yesterday—or ten years ago—and look principally to subsidies, higher tariffs, and tax relief to solve their problems, then they will not only have to be satisfied with the left-overs of the young man crop, but the industry will probably drift into the status of a Government ward. God forbid!

Fundamental Research Is Neglected

"Who has been carrying out long-range mineral dressing research, how much has been going on, and who has been paying for it? A handful of university laboratories, generally each with no more than three or four graduate students guided by one or two faculty members, account for perhaps half of such work. Expenses are squeezed out of department budgets which generally do not amount to enough to keep the mineral dressing instruction laboratories up to date. At most a half dozen papers on fundamental research might appear in one year. The emphasis in Bureau of Mines and industrial laboratories is on quick solution of day-to-day problems. In some laboratories there are the additional handicaps to fundamental research in policies of non-publication and non-discussion with fellow workers in other companies. It is despite this situation that a few scattered individuals have contributed important mineral dressing work on problems of long-range interest.

"Are there long-range problems in mineral dressing where the prospects of worth-while discovery will justify large expenditures for research? Emphatically yes. Here is a small start on a list of such problems:

"Most mineral dressing plants have crushing and grinding operations, and the power consumed in these operations is generally a large item of operating cost; frequently, in flotation plants for example, the largest single item. One of the larger copper plants may pay a power bill of half a million dollars or more per year just for crushing and grinding. The total yearly expenditure by industry for power for crushing and grinding amounts to many millions of dollars. How efficiently is that power being used? We do not know the energy efficiency of comminution. Best guesses on the basis of the little scientific work done on the subject indicate an absolute efficiency under one percent. Perhaps this low efficiency is an inherent feature of mechanical comminution; perhaps not. I would guess that the total being spent throughout the colleges and industry on this problem is well under $5,000 annually. Is this adequate in view of the millions of dollars worth of heat we now believe are dissipated into the air annually by comminution apparatus?

"There is much we do not understand about the behavior of particles in liquids, about the characteristics of suspensions of particles in liquids, about agitated beds of solid particles, etc. There is room for development of new methods of gravity concentration. It is not unlikely that methods can be developed which will be effective in the particle size range now monopolized by flotation. Such methods should be of particular interest to the iron industry.

"I don't have to make a case as to the fertility of flotation as a field of research."

The Brodie System Provides A Portable Airport

JAMES HOBE BRODIE, Captain, Army Air Forces

ACCESSIBILITY and transportation are two problems which confront engineers and operators of isolated mining enterprises in the exploratory or early development stage. Provision of adequate transportation is especially difficult if roads and railroads are absent and the terrain is rugged and covered with forests or marshes.

Air transportation would appear to be the solution to such a problem of accessibility. However, as is often the condition, there may be no place near the proposed site where an airplane could land to haul in any equipment. Furthermore, there may be no place where a level runway could be laid out even if the initial equipment could be hauled overland "by brute strength and awkwardness." Therefore, the idea of air transportation may be presumably unfeasible.

However, it can be done! And the methods for providing air access to such a difficult location is both efficient and economical. That method, "The Brodie System," a portable airport, was designed by Capt. James Hobe Brodie, of the Equipment Laboratory Air Technical Service Command, Wright Field, Ohio, and developed by the Army for military use during World War II. Rigid secrecy restrictions have now been lifted and another invention born of military necessity is available to meet new civilian demands.

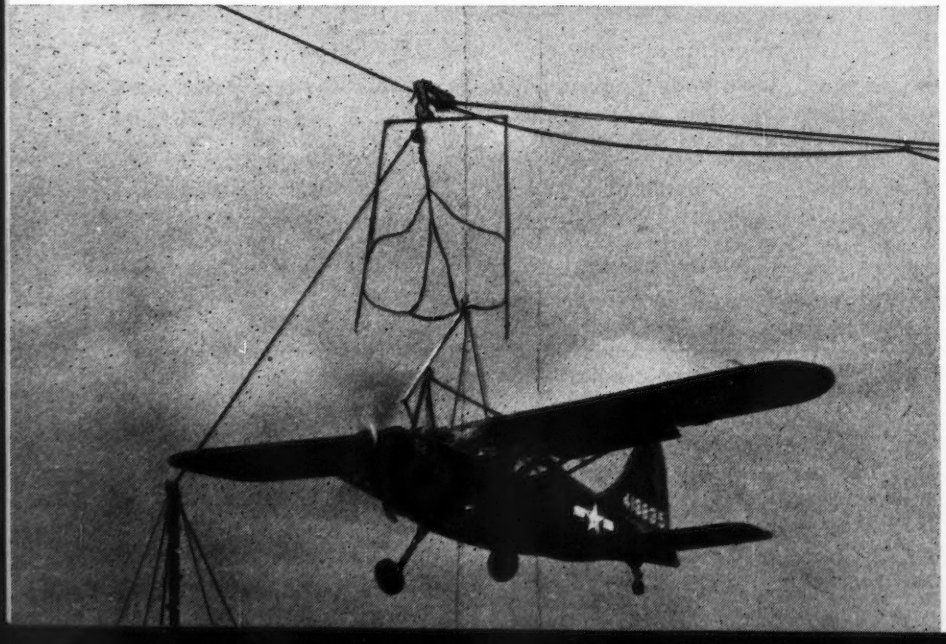
This device enables an airplane to land and take-off on a cable. It was used successfully by the Army under many and varied conditions of terrain and soil surface which could have ordinarily prevented air operations.

The Brodie System is designed for portability. A complete set of rigging and apparatus to accommodate the Army's L-5 liaison airplane (2,250 lb. gross weight and 185 hp.), weighs little more than 6,000 lb. and can be dismantled into sections and parts weighing between 20 and 200 lb. The one exception is the runway cable, which is the heaviest part, weighing 630 lb. A crew of six to ten experienced men can erect the apparatus in approximately twelve hours.

One can readily see the advantages of the system's portability. If a location is accessible by foot trail, the equipment can be packed in on mules and erected by hand-operated tools and gear. Axes, machetes, and cross-cut saws would be the only equipment needed for the removal of trees or brush obstructing the cable runway's flight approach and take-off clearing.

If the desired location cannot be reached expeditiously by trail, this portable airport, with all necessary equipment, can be dropped by parachutes from a cargo airplane. Even the erection crew can parachute in if necessary.

SPECIAL HOOK ON INCOMING AIRPLANE engages loop of a sling which is suspended from a trolley on the runway cable. A reel-and-brake mechanism brings the airplane to a stop within several hundred feet of the engaging point.



Rig Is Simple

The Army Air Forces standardized the Brodie System for military use. It is a simple rig having four masts which support a tight cable 500 ft. long and 50 ft. above the ground. The runway cable serves as an aerial tramway to support a trolley, from which a plane hangs like a "right-side-up bat."

For a take-off the plane's motor is "revved" to full power, the pilot releases a hold-back attachment and the plane, supported by the trolley, gathers speed until airborne, at which time the pilot releases the plane from the trolley by a control in the cockpit. The airplane is then in free flight and after clearing the horizontal cable overhead, it assumes a normal climb.

Thus, planes can take off from this aerial runway in about one-half the distance required for a conventional take-off run from the ground. This feature is as important to potential users as its portability.

For a landing, the airplane is flown in on a power approach technique. The course is straight and parallel to the runway cable for about 1,000 ft. The plane flies between the masts and below the runway cable. A special hook on the plane above the wing engages a large sling lightly held in a spread position and attached to the trolley at the approach end and directly

below the runway cable. This airplane hook was specially designed to enable easy engagement with the spread loop of the sling. Upon engaging the sling, the airplane pulls the trolley along the cable and is gently retarded in speed until stopped within several hundred feet, by a special reel-and-brake mechanism.

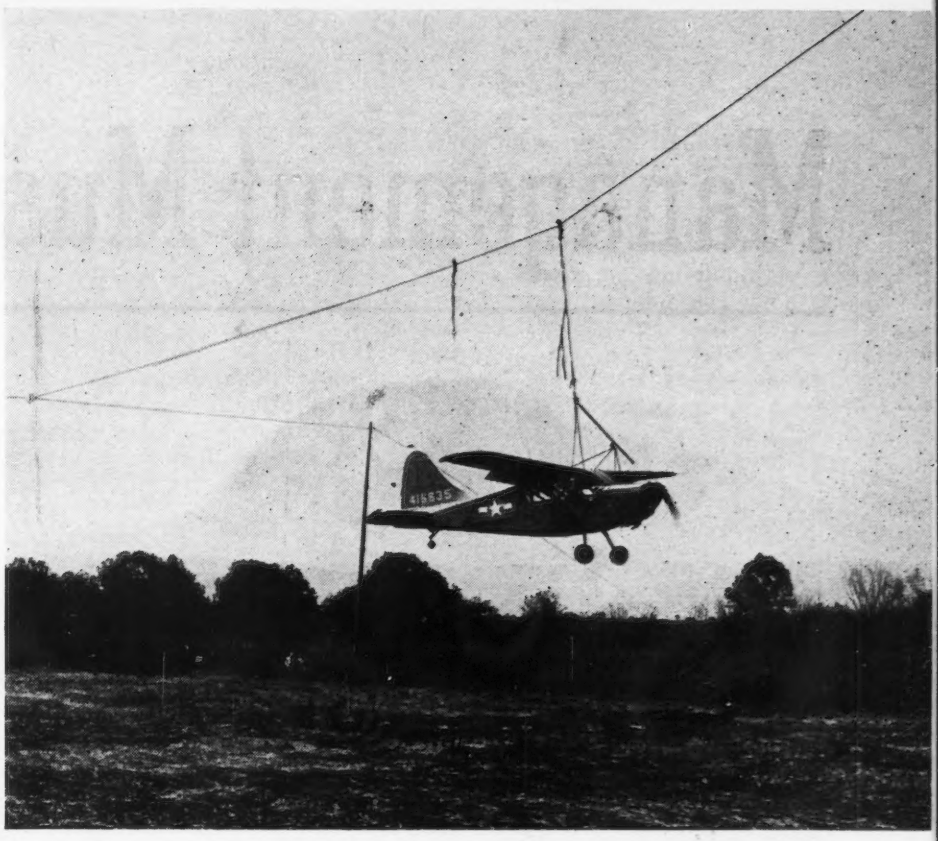
For loading and refueling, the plane is raised or lowered to and from the runway cable by a lightweight, portable, power-driven winch.

Take-off Is Easy

The Army found that any competent pilot could land and take off from this apparatus after one or two demonstrations. In fact, it was preferred by many pilots to conventional ground operations. The reason—it's safer! All fliers know the hazard of the take-off and landing. They also know that the majority of airplane accidents are caused by ground loops and nose-overs or result from landing-gear failure. The Brodie System entirely eliminates these flying hazards.

This device also eliminates the necessity for an airplane's landing gear, which is one of the costliest items in plane construction, and also effects a 25 to 35 percent increase in payload capacity. One manufacturer, anticipating the appeal of this feature, is contemplating the production of an airplane for exclusive operation with the Brodie System. Incorporated in the design of this new plane will be the special hook described and the elimination of conventional wheel landing gear. This craft will be a "flying work horse," being simply and inexpensively constructed with large cargo-carrying capacity for low operating costs. It is being designed for comparatively short flying range—i.e., 200 miles or less —and will cruise at about 90 m.p.h. Its chief function will be the transportation at a low cost per ton-mile, of sizable loads over comparatively short stretches of rough terrain or congested areas. It will have a greater payload capacity relative to its gross weight, and will cost less to purchase and operate, than any present commercial model.

However, as this new plane is still in the drawing-board stage, men in the mining industry are perhaps more interested in the use of conventional, commercial aircraft with the Brodie System for landing and taking off from a cable runway.



TIGHT CABLE WHICH SERVES AS A RUNWAY is suspended from cross cables supported by four masts. Airplane may be raised or lowered for loading or refueling by light power-driven winch. This system eliminates many landing hazards.

The following are approximate figures for such applications:

To accommodate a plane with a load-carrying capacity of 1,500 to 2,000 lb.—(e.g., single-engine Noorduyne "Norsemen" and twin engine all-metal Beechcraft)—a set of Brodie System equipment would weigh about 8½ tons and cost about $11,000. Planes of this design and capacity are suitable and are now employed in various types of industrial operations.

To accommodate light planes (such as the Piper Cub, the Taylor Craft) a set of this equipment would weigh about 1½ tons and cost less than $3,500. These light planes are used in a number of industries for the rapid transportation of personnel, mail, and light machine repair parts to remote areas.

Planes are now being made to design a cable runway for the heavier transport-type airplane in the weight range of 26,000 lb. and up. Use of the Brodie System by such heavy craft will increase payload capacity and permit uninterrupted year-round operations of runway facilities independent of mud in tropical areas and independent of snow, ice, and slush in northern country. The weight of the apparatus for the accommodation of heavier craft will increase in relative proportion to the weights of the airplanes in question. It follows, of course, that the equipment required by the larger and heavier planes will not be as readily portable as that for the lighter craft. However, all of the equipment will be capable of transport by air, and one method for making a heavy installation in an isolated location would be through the use of medium-weight planes and Brodie System rig for hauling in equipment and machinery to install the heavier rig for big aircraft. This would do the job by a step-up process.

Cost Is Reasonable

Potential commercial users of the Brodie System should note that the cost of the apparatus in all instances will bear a reasonable ratio to the commercial sale price of the planes for which the equipment is designed.

On the basis of its military record, air enthusiasts predict that the Brodie System will aid air-minded Americans in extending the usefulness of the airplane well beyond its former limitations. Thus a valuable wartime idea will serve an even greater peacetime function.

The device is being offered for commercial use, and inquiries may be addressed to Captain Brodie at Wright Field, Dayton, Ohio. Patent pending. Serial No. 557,211. All rights reserved.

Management Must Initiate-

LEE H. HILL,
New York, N. Y.

IN ITS HANDLING of problems of technology, industrial management in this country has proved itself second to none in the world. This is true of mining as well as manufacturing—indeed, of all our industry. Yet in the field of human relations management in general has not distinguished itself so well.

It is time for management to strengthen its defenses in labor matters, true enough; but it is also time for management to take the initiative in human relations just as it has in technological matters.

Employees vs. Unions

The problem of human relations or employee relations is often confused with labor relations. There is a great difference between the two. Employee relations covers all the myriad of contacts between management and its employees; labor relations covers only the area of contact between management and the labor unions representing some or all of its employees. Of late there has grown a dangerous tendency to confuse unions with employees, whereas unions are merely the agents of the employees for purposes of collective bargaining. And in addition a local union leadership may frequently owe allegiance to an international headquarters which is distinct from both employer and employees.

One example will suffice to show that great differences in interests may often exist between some or all of the employees and their own union representatives. Maintenance of membership for "union security" has become an almost primary demand for any union in collective bargaining negotiations. It is frequently deemed by union officers to be the most important of all their demands. Yet maintenance of membership actually provides less security for individual employees because it makes their jobs dependent upon maintaining good standing in the union. Only under unusual conditions will the rank and file employees consider maintenance of membership as important as do their union leaders.

That example is an indication of the great area in which the demands of union representatives are not necessarily coincident with the wishes of the majority of the employees. Therefore, it becomes clear: first, that there may be a diversity of interest between union representatives and employees; and, second, that the union relationship is only a part, and a relatively small part, of all employee relations.

Not Abdicate

As the first step in improving its position, management must examine the whole broad field of its employee relations, for if these are good, the worst problems of labor relations may never arise.

Employee relations covers all the points of contact between employer and employee. These relations begin at the moment a man is hired and then assigned to a job. Unless a closed-shop agreement exists, there is no labor relations aspect to this procedure.

Thereafter the new man is introduced to his foreman, shown what he is to do, told where he is to eat lunch, what to do if he gets hurt, when to quit work—all the details

of the starting routine. In fact, as long as he is on the job, probably the most important single factor in a worker's mind is his foreman's attitude and what the foreman will or will not do to help him.

A man's pay check comes, not from the union, but from the company. True, the union may have had a lot to say about the amount of the check, but nevertheless the employee regards the checks as coming from the company and determined in amount by the company. In all his working life, the natural person for the worker to go to with a problem or question is his foreman. Only when the foreman does not handle the question or problem in a manner satisfactory to the employee is he likely to resort to the union steward. Right at that point employee relations are transformed into labor relations.

Aside from these main points of contact, such elements as safety on the job, ventilation, supply of materials and equipment, setting of incentive wages, provision of change houses and sanitary facilities, group insurance, retirement plans, transportation to the job—all these things and others like them go to make up the entity of employee relations.

Poor Employee Relations

The results of poor employee relations soon become all too plain. Employees begin to feel sorry for themselves; they brood upon grievances, real or imaginary, and their capacity for work diminishes markedly. Uncooperativeness is the first sign of worsening relations, and there is in all companies at least one employee who is naturally uncooperative and who uses the troubled atmosphere to spread his sour philosophy.

Discontent grows, and with it unrest, both manifesting themselves in absenteeism, frequent requests for transfers, outrageous wage demands, trumped-up grievances. The result of these things may well be militant unionism leading to open conflict, for nothing is better ammunition for a militant labor leader than poor handling of employee relations problems by management.

All this, if it is allowed to go on, can result in but one thing: a bad name for the company. Men who want to work in peace will be repelled by a reputation for strife and violence, and the men who do continue to work will certainly fall far short of acceptable production standards.

Where good employee relations do not exist, it is easy to blame many things for the condition. We can point to the employees and say they are lazy and unreasonable. We can point to the union and say that it prevents management from doing the right thing. We can point to union leaders and say they are trying to undermine management and invade its sphere of authority. We can point to the national Administration and say that it encourages loafing and is opposed to business. We can point to the critical times in which we live and say that in these days we can't do anything with labor.

There is an element of truth in all of these, just as there is an element of truth in all excuses and alibis. But when we resort to these excuses, let us remember that none of these influences can wholly destroy a sound employer-employee relationship if management itself is united, alert, sound, and enlightened.

Unity in management means simply that all management representatives must work together toward a common goal in employee relations, which is clearly understood by all of them. Also, each such representative must put the welfare of his company above the interests of his own unit. The supervisor who throws part of his load onto someone else in order to make a good showing is disloyal to his company. Likewise, the company must realize that if one super-

Lee Hill's ideas on employee relations grew out of his work in one of the most difficult labor situations of the past few years. Although all of his prior experience and training lay in electrical engineering, he took over direction of industrial relations at Allis-Chalmers Mfg. Co. in 1941 at a time when bitter strikes had halted production and negotiations seemed deadlocked.

Somehow or other, things were straightened out, and Hill carried on, learning about labor relations as he went. Not only has peace since prevailed at Allis-Chalmers, but Hill's reputation for soundness, strength, and fairness won national recognition during his service throughout the war as an industry member of the War Labor Board.

Lately Hill has been active in the Labor-Management Conference in Washington, where the effect of his ideas may be observed in management's new awareness of its rights and functions.

At present, Mr. Hill is publisher of *Electrical World*, a McGraw-Hill publication.

visor is in trouble, all of management is in trouble. Unity (so far as outsiders are concerned) has been the watchword in the labor movement from its very beginning; so, too, should it be the watchword of management.

Alertness to the other man's point of view is the greatest single instrument for a smooth relationship within any organization. The flotation operator is alert when he senses a changed condition building up in his machines. In the same way an alert supervisor can sense trouble building up among his men and often eliminate the cause before it flares into the open. The whole question of good foremanship is tied up in this quality of alertness, and it is worth endless study on the part of management.

Soundness in management lies in basing decisions and instructions on facts. The management representative who substitutes a loud voice for knowledge of the facts belongs only in a medicine show. Few things damage management's prestige so severely as a hasty and unjust action based on a half-knowledge of the facts of the case.

Enlightened management looks at things from the long-range viewpoint. It is conscious of its responsibilities and will not hesitate to subordinate its personal feelings and impulses in favor of actions based on the welfare of the entire organization. This means admitting a wrong, if one has been done, and correcting it promptly. It is no triumph to win a game if it wrecks the team; and similarly it does a company little good to win a point or cut a cost if in doing so every employee is antagonized and embittered.

But remember enlightened management is not weak management. Having brought out the facts and thought the problem through, management must stick fast to its convictions. Under a weak management, the company is at the mercy of the first strong force that comes along, whether it be a rival organization, a new technological problem, a discontented employee group, or a militant union. Strong management is essential, but there is a vast difference between strong management and arbitrary management.

All of the foregoing can be stated quite briefly by saying simply that to preserve good employee relations, it is up to management to do for the individual employee those things that neither he, himself, nor his union can do. Only management can provide the satisfaction and the opportunity for growth on the job that most workers really want. If management is united, alert, sound, and enlightened, these things will be provided.

Our Responsibilities

Obviously, in what I have said up to now I have dealt with a management free to exercise the rightful functions pertaining to management. Without going into too great detail, we can state briefly the nature of management's responsibilities, from which will be apparent the functions by which those responsibilities may be discharged.

First, management must so conduct the business that its product can be sold at a price the consumer will pay.

Second, management must make a profit for the stockholders who own and finance the enterprise.

Third, management must aid in upholding the community through continuous employment and by support of local institutions.

Fourth, management must satisfy the wants of its employees in a sound employee relations program.

Every time a question of a management function or right is discussed, it should be weighed in the light of the foregoing responsibilities. If loss of the function in question would impair fulfillment of these responsibilities, that function should never be surrendered.

Now there is usually only one place where the question of management's rights or functions ever comes up, and that is in collective bargaining negotiations or in hearings on labor matters. This is the place, then, where unwise or hasty dealings with a union can completely wreck a management's power to achieve a sound employee relations status and properly to discharge its fourfold responsibilities. In my work with the War Labor Board I have seen cases where a management had so tied its hands by unwise concessions to a union that it could not perform even the most elementary functions of management. Conditions in such a plant were chaotic, to say the least.

Dangers to Management

Let us, then, examine the contracts that govern labor relations in the light of possible dangers to the free use of the functions of management. Every collective bargaining agreement I have ever seen could be broken down into the following groups of clauses:

1. Union protective clauses.
2. Management protective clauses.
3. Employee protective clauses.
4. Seniority clauses.
5. Grievance handling clauses.
6. Miscellaneous clauses.

Certainly one could discuss at some length each one of these groups of contract clauses,* but for present purposes I will confine myself to the various maneuvers in collective bargaining by which management's functions may be impaired or destroyed.

Because managements bear the responsibility for creating a successful enterprise, they are likely to regard as inalienable the rights and prerogatives they believe necessary to effective control of the business. Unions for the most part do not share this view. "Management prerogatives" to most unions is a fighting phrase, and many labor leaders regard management rights or func-

*Ed. Note: For a fuller discussion, see *Management at the Bargaining Table*, Hill and Hook, McGraw-Hill Book Co., Inc., New York, N. Y., 1945.

tions as merely obstacles in the union's path to freedom of action.

This attitude is due partly to the union leader's desire for more power; partly to the union's desire to improve its strategical position; partly to the union's feeling that management has been stubborn, unwise, or arbitrary in the exercise of its functions. To be met with a flat refusal, not only to grant a certain request but even to discuss it, because the matter touches upon a management function, is almost certain to harden a union's will to deprive management of that very function, or at least to gain a voice in the use of it.

The Flank Attack

Union leaders have learned, however, that direct open attack upon the functions of management is seldom as effective as a flanking maneuver that reaches its objective before its purpose is discovered. Four such flank attacks have been particularly successful. At first glance they seem reasonable enough and some managements have therefore yielded to one of them on the flank in order to gain denial of a wage increase, for example, in the center. Too late the result has been found to be loss of control of the enterprise.

These four flanking maneuvers may be termed: (1) mutual-consent clauses; (2) joint committees of labor and management; (3) determination of promotions by absolute seniority rather than managerial discretion; (4) unlimited arbitration.

Mutual consent clauses constitute bargaining booby traps. They sound innocent, but what they say in effect is that management cannot make a certain decision unless the union or the employee agrees to it.

Consider the following promotion clause: "No member of the Union Executive Board or Shop Committee shall be promoted to a supervisory position without the consent of the union membership. Employees shall not be promoted to supervisory positions while charges are pending against such employees in the union."

In the foregoing case, the union prevented the promotion of employees best fitted for it by simply filing charges against them. Good management requires selection of supervisory employees on a merit basis, and neither unwise choices by members of management nor a union veto should be permitted to interfere with such wise selections.

Transfers between departments or shifts, new job classifications, leaves of absence, and other matters have been made the subject of mutual-consent clauses, and nearly always to management's regret. Even plant discipline has been subjected to mutual agreement, as in the following clause:

"The company may discipline or discharge any employee for just and proper cause, except that before any employee is disciplined or discharged there shall be a hearing and mutual agreement between the Shop Committee of the union and representatives of management appointed for such hearings. The decision, if mutually agreed upon, shall be final and binding upon both parties."

It should not be necessary to add that discipline in the plant where this clause was effective became so shockingly bad that a Congressional investigating committee later reported, "Foremen who found idling workers disobeying regulations were brushed aside by employees secure in the knowledge that they could not be discharged or disciplined without the consent of the union, and that such consent would not be forthcoming."

Mutual-consent clauses covering any phase of management's planning, direction, and control of the enterprise should be avoided like the plague.

Joint committees may be mutual-consent clauses in disguise. The growth during the war of labor-management committees was of great value in some cases in strengthening our industrial war effort, but note carefully that these committees were purely advisory, with management left free to accept or reject their recommendations.

If the right to *exercise* a management function is handed over to a joint committee, the union has acquired a veto power that it can use to block operations whenever it wishes. For example, unions are tending to demand equal participation with management in the setting of incentive wage rates, a situation that will inevitably produce controversy of a kind often used advantageously by a union. Power to determine incentive wage rates, training methods, safety regulations, job evaluations, anything that is peculiarly a management function, should never be delegated to a labor-management committee.

Seniority propounds a question so complex and so loaded with dynamite that it would be impossible to do it justice within the space of this article. I can only recommend thorough study on the part of every management man of the whole matter of seniority.

Seniority a Problem

I have included it here because obviously the strict application of seniority eliminates management discretion in the vital fields of promotion, demotion, and transfers and substitutes a mechanical succession that ignores employee merit and ability.

Now there is justification for considering length of service as an important factor in job assignments, lay-offs, and re-hirings. In fact, the union demands for seniority undoubtedly have sprung from employer neglect of this factor. Yet it must be recognized that substitution of mere time serving for ability as the only criterion must inevitably result in loss of management efficiency and effectiveness.

Unlimited arbitration is a process whereby management can easily transfer its rights to a third party outside the company and unfamiliar with the special conditions prevailing within it. This process usually begins in a grievance-procedure clause that provides the method for handling "grievances or complaints" without defining them. Such methods run through consideration at various company levels and then wind up in outside arbitration. There is a danger in this unlimited arbitration that is not immediately apparent.

Only brief consideration will show that certain functions of management are not open to question by a union and certainly should not be subject to adjustment by a third party, however "impartial" he may be. Management has certain rights

that grew out of the employer's ownership of the property, its equipment, and the material produced, and out of the relationship of employer and employee. These rights of the employer existed before he engaged in collective bargaining and they continue to exist, *except as they are specifically modified by the terms of the collective agreement.* The employer, therefore, retains every single right he had before the agreement was signed, unless he has relinquished it by a provision in the agreement. Managements should take care that nothing in the agreement may be construed to upset this fundamental fact, sometimes called the doctrine of pre-existing rights. They should beware of elaborate "harmony preambles," for in this thicket of verbiage may be concealed a phrase limiting some of these pre-existing rights. And, above all, the field of application of arbitration should be strictly limited and defined.

Management Clauses

As to whether or not a "management clause" should be included in a contract as a means of protecting these rights there is considerable difference of opinion. One school of thought holds that an attempt to state precisely, and to reserve, the rights of management may result in the loss of rights that were overlooked and unstated. Others believe that management's rights should be protected specifically within the contract. Certainly if a management clause is used, it should be properly safeguarded so as to cover any rights not specifically mentioned. For example, after mentioning management's sole responsibility to hire, to maintain discipline for cause, and to maintain efficiency, one such management clause continues, "the union recognizes other rights and responsibilities belonging solely to the company, *prominent among which, but by no means wholly inclusive,* are the rights to decide the number of plants," and so on.

Another management clause ran, "It is understood and agreed that any of the rights, powers, or authority the company had prior to the signing of this agreement are retained by the company, except those specifically abridged, delegated, granted, or modified by this agreement." Another defense, if management rights are mentioned in the agreement, is to specifically exempt them from arbitration.

No management can attain efficiency in operations if *any* dispute between it and the union is subject to binding decision by an arbitrator. Such a situation in the hands of a union anxious to harass management, could in effect supplant the manager and board of directors by a referee who is not held responsible for later success or failure of the enterprise.

On the other hand, there is no valid objection to the parties agreeing to submit to a referee all questions as to interpretation or alleged violation of the agreement upon which they are unable to agree.

Limit Arbitration

However, demand for unlimited arbitration is probably the most serious of the four means of flank attack upon management's functions, and it should be guarded against by the following defenses:

1. Possible use of a general management clause.
2. Grievances which may become subject to arbitration should be limited by definition to disagreements as to interpretation or alleged violation of the agreement.
3. The referee's jurisdiction should be clearly defined; it should be made clear that he can neither add to, subtract from, or modify the agreement.
4. Management functions recited in the agreement should be exempted from arbitration.

These flanking devices: mutual consent, joint committees, seniority, unlimited arbitration, should, therefore, be guarded against by watchful managements. Yet when unions make such far-reaching demands, managements that are wise, as well as watchful, will not simply dismiss them as absurd. The underlying cause for such demands should be determined, and it may well prove to be some apparently unrelated abuse or omission that management can correct. Even while stoutly denying an outrageous demand, an alert, sound management will look for the disease among the employees of which the demand in question may be the symptom. If the cause is an undesirable condition, practice, or policy of management, it obviously should be corrected.

Protecting Management

In addition to recognizing the nature of possible attacks on its own position, management should not overlook the importance of presenting demands of its own for clauses in its collective-bargaining contracts which it feels necessary for satisfactory union-management relations. Collective bargaining is not a one-way street. As George W. Taylor, in *E.&M.J.* for May, 1945, well stated, "It is management's duty to make such demands on the union as are necessary to preserve the employer's ability to perform its functions." Management is only just beginning to partake of this action, hitherto reserved for labor.

I strongly urge, therefore, that managements line up in their own minds the protective clauses they lack in their own agreements. These should cover things like adequate definition of the bargaining unit, specification of supervisory employees not covered by the agreement, proper definition of grievances, the right to promote, demote, transfer, and so on. Then, in addition, specific demands on the union may well be made, if conditions warrant, for definition and guarantee of union obligations and responsibilities, such as noncoercion of employees; no-strike, no-lockout clauses; good-faith clauses; regulation of union activities on company time, and others.

No Blind Authority

All these things, it must be remembered, are but the minimum considerations that must be given to the problem of protecting the right to manage. Management must certainly retain unimpaired as much authority as is essential to insure a successful enterprise, but it must use judgment in wielding that authority.

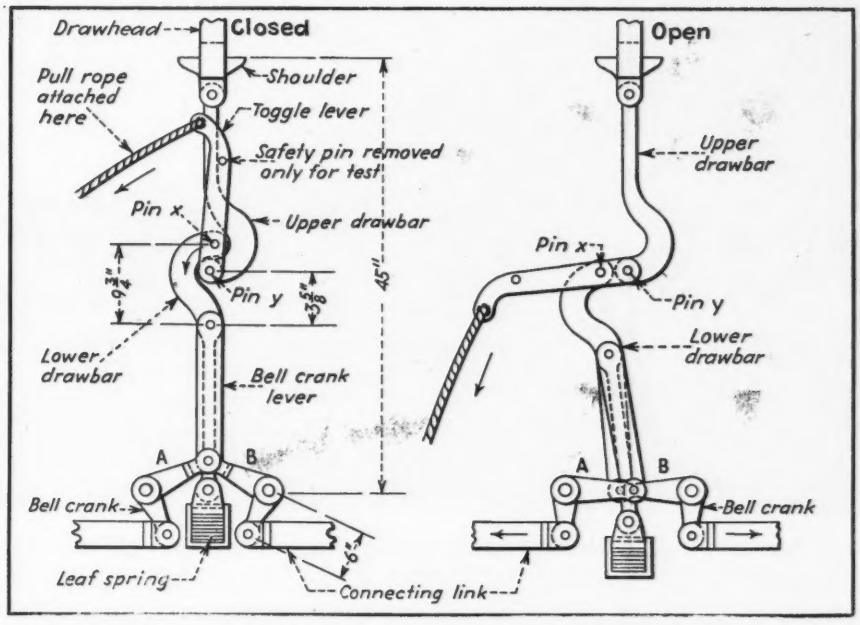
The arbitrary exercise of any right, simply because one has the legal right or the power to be arbitrary, is the surest way eventually to lose both right and power. Despite the overwhelming proof of this statement that experience affords us, we find today many among our citizens who still wield power autocratically.

Let us who are members of management demonstrate that our intelligence and our ability are of a higher order than the blind wielding of arbitrary authority. Let us protect our rights, but let us also strive to build for ourselves and our employees a decent, productive, cheerful place in which to work and to live. If we of management become united, alert, sound, and enlightened, if we take thought for the individual employee's feelings and aspirations as well as our own, we cannot fail.

Bear-Trap Device Tests Cage Dogs

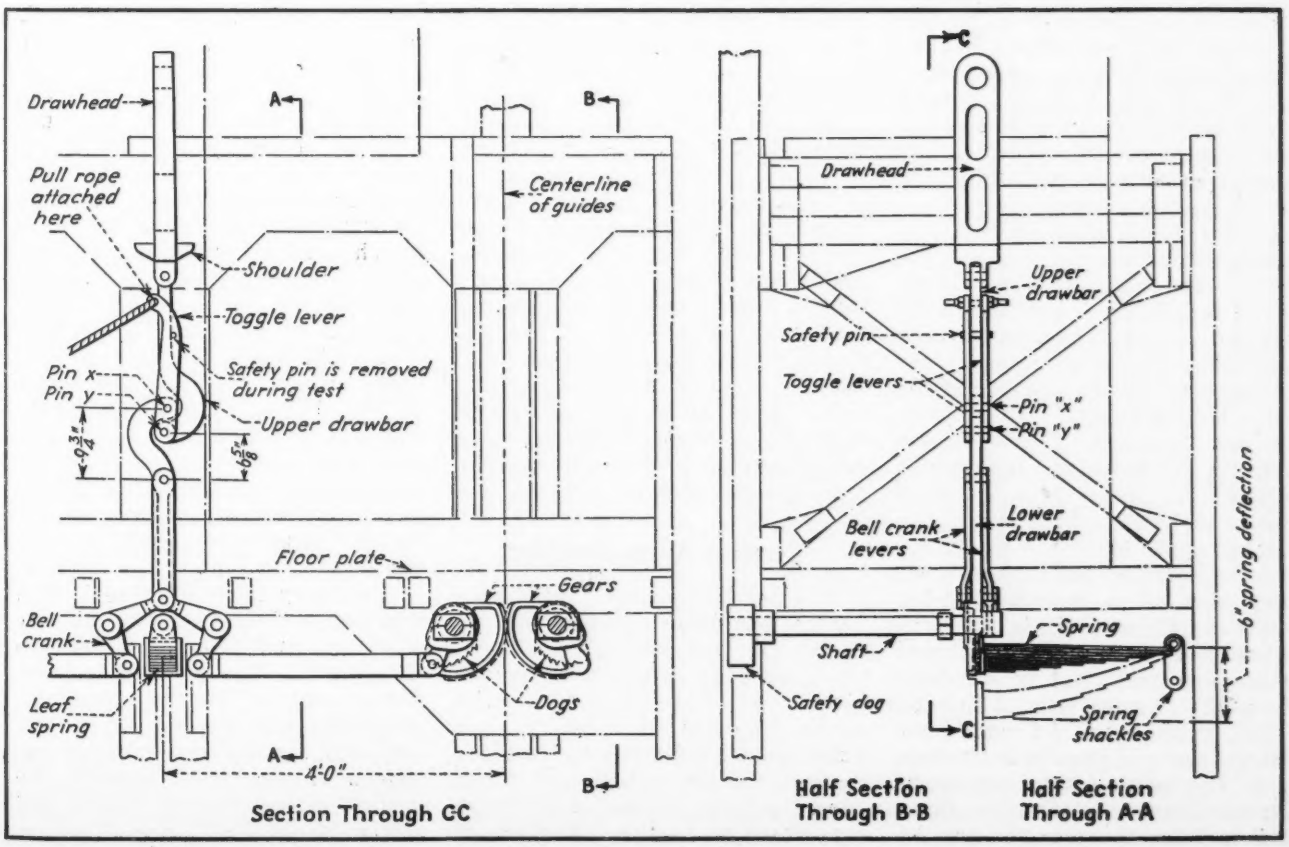
SAFETY DOGS installed on double-deck man-cages in the 12x6-ft. shaft of the Lake Shore Mines, Ltd., Kirkland Lake, Ontario, are tested with a bear-trap release. As indicated in the accompanying illustrations, submitted by J. G. W. Purdie, mechanical superintendent, tests can be made while the cage is in motion, thereby simulating conditions which might exist during an actual rope failure. Effectiveness of the cage safety device is thus more positively ascertained.

When tests are made, the cage is hoisted above the collar of the shaft and then lowered so that it attains a velocity of approximately 100 f.p.m. by the time it reaches the collar. The rope attached to the device is pulled by a man at the top station. The semi-elliptical spring exerts tension on the lower drawbar and sets the dogs. Mechanics have ample opportunity to check performance of the safety device and make any adjustments necessary to bring the cage safely to a stop in event of an emergency. The device was introduced by D. L. Cramp, former mechanical superintendent, and has performed satisfactorily.

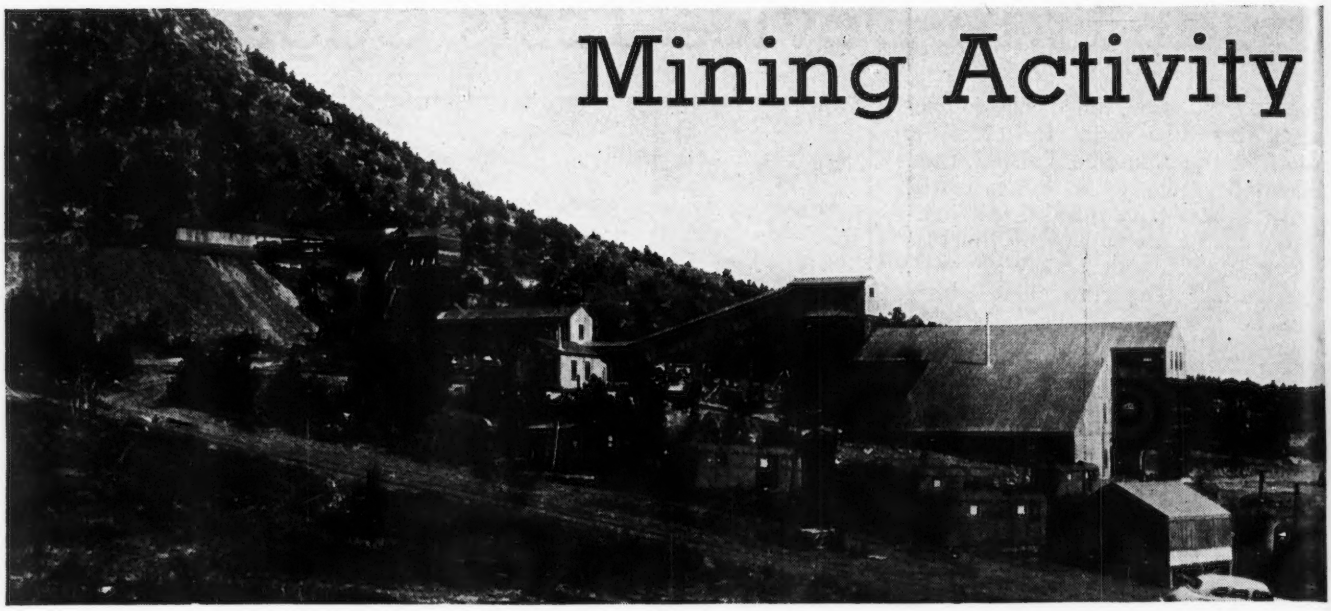


THE BEAR TRAP interposed between the cage drawhead and semi-elliptical spring acts as a trigger when released as shown above. During tests, a safety pin in the toggle lever is removed. Note relative motion of the spring, partial rotation of the bell cranks, and lateral motion of the links which cause the safety dogs to engage the wooden shaft guides. Four guides are used in the shaft.

INSTALLATION OF THE BEAR TRAP is shown below. To re-set the dogs after tests, it is merely necessary to slack off on the cable about 6 in. This lowers the upper drawbar sufficiently to permit re-locking of the bear trap in normal position.



Mining Activity



THIS 200-TON FLOTATION PLANT of the Callahan Zinc-Lead Co. at Mt. Hope produces cadmium-bearing concentrates.

JOHN B. HUTTL, Associate Editor

A QUESTION ASKED with increased frequency by Western mining men is "What's Going on in Eureka?" In view of the many rumors circulated in recent months as to new discoveries made and the reopening and development of old properties, the heightened interest in the historic and once productive Nevada mining camp is quite understandable. *E.&M.J.* is now in a position to substantiate these rumors, for a field trip undertaken recently disclosed a notable renewal in mining activities in this district.

It was found that three major mining companies are active in the area, with Eureka Corporation, Ltd., a subsidiary of Ventures, Ltd., of Torotno, carrying out systematic development to determine the productive possibilities at depth at the Ruby Hill property of Richmond-Eureka Mining Co., under lease from U. S. Smelting, Refining & Mining Co.; the owners, Callahan Zinc-Lead Co., starting active production at the Mt. Hope zinc mine, 24 miles northwest of Eureka, after completion of a modern 200-ton flotation mill; and U. S. Smelting, Refining & Mining Co. diamond drilling a zinc property on Lone Mountain, 18 miles west of Eureka.

The area visited, of which the historic town of Eureka is the hub, is in the southeastern corner of Eureka County, and mining dates back to 1866, the year the first location was made in New York Canyon, on the east flank of Prospect Mountain.

With no public power service available to the district, most power required for mining and milling operations and for the town of Eureka is generated by diesel and other types of internal-combustion engines. However, a movement is under way to extend the Boulder Dam power line serving Pioche to Eureka. As to water resources, there are a number of springs on the mountain sides and at the edges of the valleys, the Fish Creek Range springs being an outstanding example, and some artesian wells are on the Bartine Ranch, in Antelope Valley, 24 miles west of Eureka. The climate is typical of that prevalent in Southwestern mining districts lying at an altitude above 4,000 ft., the summer months being hot and dry, but the nights always cool, and the winters cold.

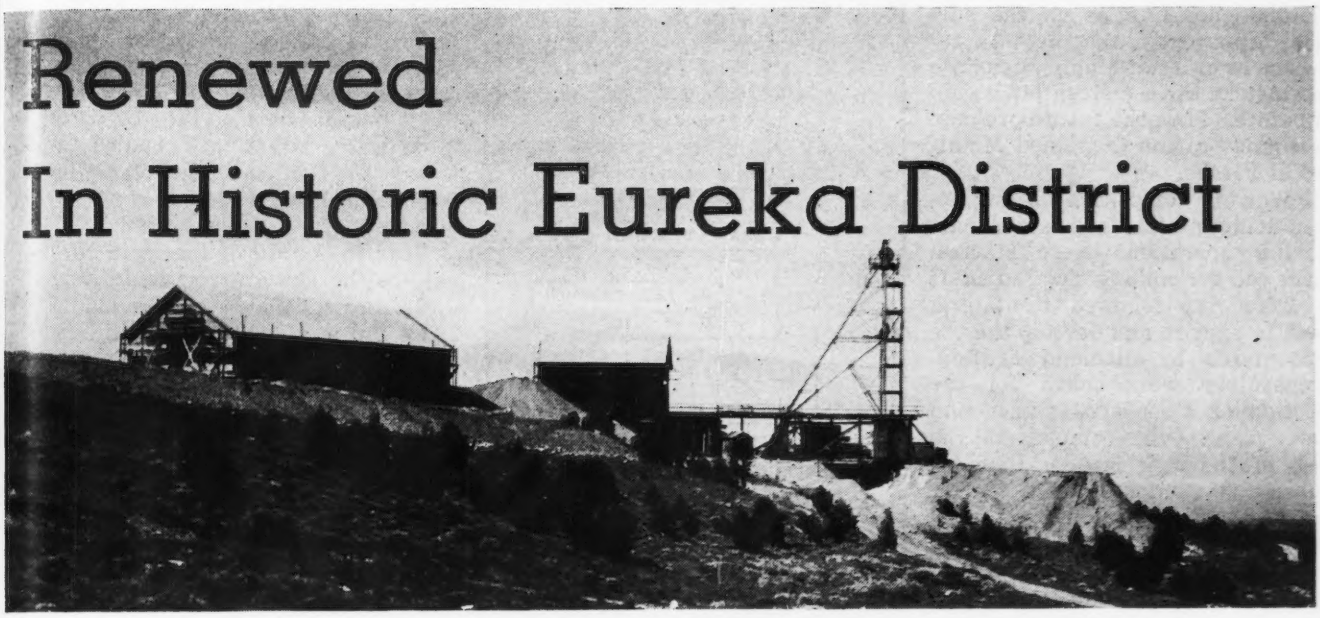
District Was Prolific

The Eureka area came into prominence soon after discovery in 1869 of the rich lead-silver-gold deposits on Ruby Hill, situated about two miles west of the town of Eureka at an elevation of 7,300 ft., and subsequent perfection of smelting methods for the reduction of mined ores. In fact, Eureka is generally considered to be the birthplace of the lead-silver smelting industry in the United States, and from 1869 to 1879 provided a substantial tonnage of pig lead for the domestic market.

The outstanding producers during the bonanza period were the Eureka Consolidated Mining Co. and the Richmond Consolidated Mining Co., organized in 1870 and 1871, respectively, and old records give the number of active mines in the district as high as 50. The 13 furnaces operating at the different smelting works had a combined capacity of 600 tons of ore a day. These were charcoal-fired units ranging in capacity from 20 to 90 tons, the height from the tuyeres to the charge floor varying from 10 to 20 ft. Air was provided by mechanical blowers. Here, Albert Arentz invented in 1870 the siphon tap. Base bullion was shipped for refining either to the Balbach works, in New Jersey, or to Selby, Calif., but this practice was stopped in 1877, when the Richmond Co. erected a refinery employing the Lucien Rozan process for delivering the bullion which the company produced.

A refinery in which base bullion was desilverized by means of zinc was constructed in 1886 by the Eureka Co. The melting and refining plants of the two companies mentioned were closed down in 1890 and 1891 respectively, owing to depletion of the rich orebodies, the decline in the price of silver, and restriction of local charcoal manu-

Renewed In Historic Eureka District



SURFACE PLANT AT FAD SHAFT where four-compartment shaft is being sunk to 2,500 ft.

facture by government edict, and subsequent mine production was sent to distant smelters. A moderate revival of mining occurred in 1906, when the combined Eureka and Richmond properties were rehabilitated and worked by U. S. Smelting, Refining & Mining Co., and the output was shipped to the Midvale smelter of the company. After 1910, the properties were operated mostly by leasers. The total production of the district from 1869 to 1936 is estimated at more than $100,000,000.

The orebodies occurring in the Eureka and Mt. Hope sections of the district were formed by alteration and replacement of limestones and dolomites. They are often irregular in form (include bedded deposits, chimneys, pipe veins, and large and small chambers associated with fissures), and in many places grade into the country rock. This is particularly true in the Eureka section, where the ores consist mainly of argentiferous carbonate of lead interspersed with nodules of galena and a large amount of ferruginous material carrying gold.

The outstanding feature is that nearly half of the values contained in the Eureka ores are in gold and silver, with gold decreasing and silver increasing with the rise in the percentage of lead. In general, the ores were deposited as sulphides and subsequently oxidized by atmospheric agencies, with oxidation in some instances reaching a depth of 1,200 ft.

The country rock in the Mt. Hope section, where some diamond drill and churn drilling and underground exploration work were done some years ago, is a highly metamorphosed limestone mineralized in certain areas. Adjacent to the limestones is a rhyolite intrusion. Most of the ore deposits occur as flat-dipping lenses (0 to 30 deg.), but in some areas practically vertical lenses or fissures are found. The ore is primarily a combination of marmatite and sphalerite, with some galena and silver. The zinc minerals carry an appreciable amount of cadmium.

Exploration Is Under Way

Extensive exploration and development operations in progress currently on Ruby Hill, involving an outlay of several million dollars, are conducted by Eureka Corporation, Ltd., George W. Tower, president. The Eureka-Richmond group of mines of U. S. Smelting, Refining & Mining Co. and adjacent properties were acquired under a long-term lease and option in 1937, with diamond drilling carried out under contract by the E. J. Longyear Co. and rehabilitation of some underground workings being started late that year. A vertical diamond-drill hole was sunk on the hanging-wall side of the Ruby Hill fault at a point 1,649 ft. north and 398 ft. west of the old Locan shaft. Drilling operations were stopped in 1938 and the hole was abandoned at 3,241 ft. because no mineralization was encountered.

The Locan shaft was next entered to the 900 level, and subsequently two vertical diamond-drill holes were sunk to a depth of 1,900 ft. and 1,600 ft., respectively. Good ore was encountered in both. As a consequence, a surface plant was erected at the site of the present Fad shaft and sinking operations were started on a small scale in 1941. The shaft is 1,400 ft. north of the Locan shaft, and is designed to reach the zone north of the Ruby Hill fault and at a depth of 2,500 to 3,000 ft., at which the diamond-drill holes established the presence of ore. It contains three compartments measuring 5x5½ ft. each inside the timbers, and a 4x5½ ft. manway. Sinking operations were stopped in October 1944 after fire destroyed the surface plant. The shaft at that time had reached a depth of more than 550 ft.

In 1943, the company, failing to obtain adequate labor forces and supplies for the Fad shaft, requested a RFC loan on the basis of the fine showing in the two diamond-drill holes mentioned previously. The Government responded by having the U. S. Bureau of Mines check the diamond drilling. Three extra holes were drilled, the work being finished in February 1945. The result of the three holes, staggered with respect to the previous holes, is optimistic. The ore found by this and previous drilling is in the down-faulted block and in the same

Eldorado dolomite as on the surface. Apparently, the ore is a replacement of a flat-dipping dolomite bed instead of in a steep pitch vein as before. Thus the future ore may be similar to the Combined Metals bed at Pioche.

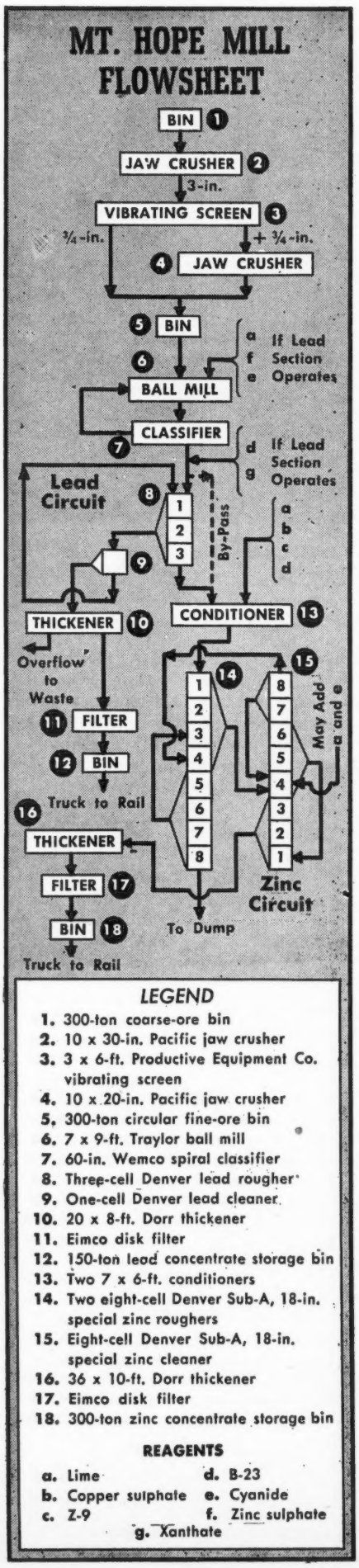
Following completion of the Bureau drilling work, large-scale shaft sinking operations were started. Plans call for sinking the Fad shaft to 2,500 ft., followed by lateral work to explore and develop the ore encountered by diamond drilling. Preparatory work called for the erection of a modern surface and power plant. Units completed at the time of the visit late in June included a 60-ft. steel headframe over the Fad shaft, a 1,200-hp. diesel plant at 7,300 ft. elevation (three 460-hp. McIntosh-Seymour diesel units direct-connected to 300-kw. generators with switchboard equipment and other control auxiliaries); a 300-hp. Lidgerwood Manufacturing Co. hoist; a 500-c.f.m. C-P compressor; and a large building housing the repair shops, change room, stock room, and office. All shaft-sinking work is done on contract by the E. J. Longyear Co., with R. L. Loofbourow in charge. Company operations are directed by George W. Mitchell, manager, and about 40 men are employed.

Mt. Hope Mine Producing

The Mt. Hope zinc property, about 24 miles northwest of Eureka by gravel road, is now operated by the Callahan Zinc-Lead Co., K. K. Hood, manager, in charge. Active work was started by the company in May, 1944, following acquisition of a long-term lease from the Universal Exploration Co., a subsidiary of United States Steel Corporation, which purchased the property after prospecting the ground by churn and diamond drilling from the fall of 1928 until January, 1930. Previous to that considerable development work was done by Thomas Wren in the early 90's, but no zinc production was made. The mine is developed by several tunnels, the principal one more than 800 ft. long, and drifts, crosscuts, and raises totaling more than 1,000 ft. In addition, there are two winzes, one inclined and the other vertical, sunk 100 ft. below the tunnel ore deposit.

The horizontal and vertical orebodies at Mt. Hope are mined respectively by open stope and shrinkage stoping methods. A Sullivan mechanical loader is used in drift and crosscut headings, and ore broken in open stopes generally is transported to loading points by scrapers operated by slusher hoists. Stope output is loaded into 1½- and 2-ton cars, which are hauled in trains to the crushing plant by 2-ton Mancha storage-battery locomotives.

Near the portal of the main tunnel are the powerhouse, containing diesel units capable of developing 1,200 hp.; a 900-c.f.m. Sullivan angle-compound compressor, and auxiliary compressor units with a total capacity of 700 c.f.m.; machine, blacksmith, drill repair and carpenter shops; warehouse; laboratory and assay office; and general office.



Flowsheet Is Flexible

The 200-ton concentrator was erected by the Western-Knapp Engineering Co., San Francisco. Milling operations were started early in July. Plant operations follow the practice explained in the accompanying flowsheet. The mine run ore is reduced to minus ¾ in. by two-stage crushing.

In the grinding section of the mill, ore withdrawn from the fine-ore bin is ground to 70 percent minus-200 mesh. Overflow is treated in the lead and zinc flotation sections as indicated in the flowsheet. It also will be noted that the lead section can be cut out of the flotation circuit whenever this is desired. Resultant final lead and zinc concentrations are thickened and subsequently filtered on disk-type filters installed above a 150-ton and 300-ton storage bin.

Mill production is trucked to Palisade, about 60 miles north of Mt. Hope, for shipment to smelters. Water for the camp and plant is obtained from a well, some 12,000 ft. from and 650 ft. lower than the concentrator, through a 6-in. pipe line. Housing facilities for miners and plant operators include 40 trailers rented from the Government, and the company operates a boarding house for single employees. A total of 80 men was employed at the time of the visit.

At Lone Mountain, 18 miles west of Eureka, U. S. Smelting, Refining & Mining Co. is diamond drilling a lead-zinc property known as the Mountain View mine, acquired under lease and option from a group of Eureka miners. The work is done under contract, and all operations are supervised by W. F. Walthall, U. S. Smelting representative.

Improving Flotation of Non-Sulphide Minerals

A. M. GAUDIN, Richards Professor of Mineral Dressing, Massachusetts Institute of Technology, Cambridge, Mass.

ALL ADVANCES in scientific knowledge, with their resultant technical applications, have been preceded by speculation, discussion, and often argument. Professor Gaudin has kindly prepared a study of the relationship of crystal structure to flotation of non-sulphide minerals, a field we believe to be the most fruitful now facing the ore-dressing metallurgist. He suggests avenues of research, discusses probabilities, and draws several interesting conclusions. It is our hope that such papers as this may aid in beginning the discussions, or even arguments, that are the forerunners of new knowledge.

The Editors

TO REDUCE the subject of this paper to workable dimensions, I have restricted my use of the term "non-sulphide minerals" to those containing oxygen or halogens. Properly speaking, non-sulphide minerals include natural metals as well as non-metals and hydrocarbons, but the behavior of these latter minerals is so radically different from that of the oxygen and halogen minerals that an attempt to cover all of them in one discussion would become unwieldy. The oxygen and halogen non-sulphides, which display among themselves certain common properties and behaviors, constitute as it is a wide field for speculation and study by the flotation chemist.

Character of Non-Sulphide Surfaces in Water

Although not all oxygen and halogen minerals have the same flotation properties, they do have the common property that their surfaces consist of ions, and that these ions can be supplied continuously by the minerals themselves, as such, or through hydrolysis of their surfaces. This fact, that they all possess ionic surfaces continuously maintained, has much to do with the flotation behavior of oxygen and halogen minerals.

The classification of crystals that appears on this page was discussed in February 1944 at a Milling Methods sessions of the A.I.M.E., which touched on the nature of fracture surfaces. The oxygen and halogen non-sulphide comprise or fall in classes 3 and 4, most species occurring in classes 4a, 4c, and 4d.

Typical minerals belonging to these various classes are:

Fluorite, class 3 Muscovite, class 4c
Calcite, class 4a Quartz, class 4d

Minerals in classes 3 and 4a fracture along cleavage planes which are roughly equivalent in a number of orientations, with the result that the particles have several flat faces and are roughly equidimensional. Each fracture surface consists of an orderly array of ions.

Class 4c oxygen minerals fracture readily along one cleavage plane but not so readily, or not at all, in other directions. Each particle, therefore, has large areas of flat surface, which consists of ions from the crystal itself, as in the case of classes 3 and 4a, or other ions produced by hydrolysis in the manner to be described for minerals of class 4d.

Quartz (class 4d) consists of a network of silicon and oxygen atoms so situated that each silicon is surrounded by four oxygen atoms and each oxygen has two silicons as neighbors. This three-dimensional network may be represented two-dimensionally as in Fig. 1.

As soon as a broken Si-O bond is formed, the extreme reactivity of the fragments asserts itself, fastening down OH^- or H^+ ions as the case may be. The net result is a complete hydrolysis of the surface. Class 4d minerals generally do not cleave; their fracture surfaces are hackly to rough or conchoidal.

Broadly speaking, it can thus be seen that class 3 and 4 minerals have this in common: their surfaces are almost completely coated with ions derived from the crystal without alteration, or by addition to the surface of hydrogen and hydroxyl ions. These minerals differ in that some cleave so as to give much continuous planar surface per unit weight (class 4c); others, less continuous planar surface (classes 3 and 4a); others still less planar surface (class 4d).

The foregoing makes clear that all broken surfaces of oxygen and halogen minerals are water-avid, because the ions in these surfaces are known to hydrate extensively. None of these minerals is naturally flotable or capable of floating unless it is contaminated.

It should be remembered that ionic surfaces are not static. All our knowledge indicates that surface ions are constantly passing into the solution, and conversely that the solution constantly deposits ions on the surface. If equilibrium

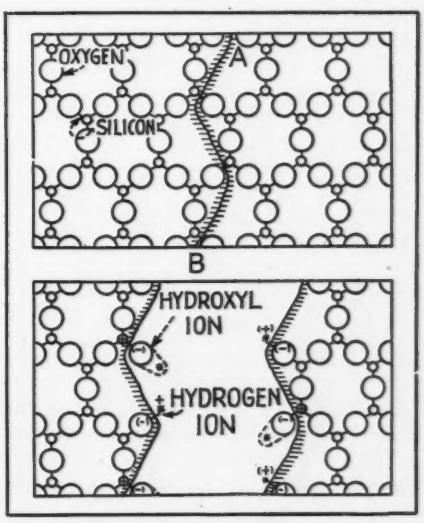


FIG. 1. Schematic representation of silicon-oxygen bonding in quartz and the absorption of H^+ and OH^- ions that results when the bond is broken in water. Because silicon-oxygen connections are shown in a plane, only three of the four valances of the silicons are represented.

Classification of Crystals

TYPE 1.	Uncharged single atoms, sharing no electrons	atomic crystals
TYPE 2.	Uncharged groups of atoms, sharing electrons within the group, but not between groups	
	(a) groups finite in all dimensions	molecular crystals
	(b) groups infinite in one dimension	giant-filament crystals
	(c) groups infinite in two dimensions	giant-sheet crystals
	(d) groups infinite in all dimensions	diamantine crystals
TYPE 3.	Charged single atoms, sharing no electrons	simple ionic crystals
TYPE 4.	Charged groups of atoms, electrons being shared within the groups, but not between groups, the arrangement being such that	
	(a) structures of zero dimension formed	complex ionic crystals
	(b) linear structures formed	fiber crystals
	(c) planar structures formed	layer crystals
	(d) block structures formed	framework crystals
TYPE 5.	Positively-charged atoms permeated by an electron gas	metallic crystals

prevails, the two processes proceed at the same rates; otherwise, one or the other prevails.

Ionic Make-up of Surfaces

If several minerals are present simultaneously in water, a wide variety of ions may be present in solution to compete for temporary anchorage on the mineral surfaces. Considerable diversity of surface composition may therefore rise.

For example, a pulp of water, siderite, and fluorite must contain the following cations: ferrous, hydrogen, and calcium; and the following anions: carbonate, bicarbonate, fluoride, and hydroxyl. It is also likely that ferric ion (from oxidation of ferrous) and complex ions of iron and fluorine will be present.

The surface of each particle in such a pulp must consist of the eight or more ions present. In all likelihood, however, the proportions of the various ions on the surfaces of the two minerals would not be the same, not only because the substratum is different, but because equilibrium conditions are lacking.

In many instances ores contain not two but perhaps five to ten minerals, all in significant quantities. For example, a manganese ore may contain manganite, pyrolusite, hematite, goethite, kaolin, quartz, and calcite. The ionic liquor here is more complex than that pictured in the foregoing. Furthermore, because equilibrium may be reached but slowly, and if in addition some ionic processes are irreversible, an ore pulp may be varying continuously over long periods. Such practically irreversible reactions include oxidation of ferrous ion to ferric, oxidation of sulphide ion to thiosulphate or sulphite, adsorption from the air, or evolution of, carbon dioxide. In this continuous lengthy adjustment an ore pulp can almost be thought to live.

The average make-up of the ions at the quartz surface will thus vary with change in the other minerals present, with the extent of surface of these other minerals, with the approach to ion equibrium that follows, and with the concentration of such ions as may be added deliberately to affect the composition of the ionic surface.

If calcium and hydrogen were the only cations present, the instantaneous composition of the cationic part of the surface would be affected by the concentrations of Ca^{++} and H^{+} ions and their relative tendencies to evolve or to be deposited. On a calcite surface present in the same pulp the same broad principles would apply, but the relative tendencies to evolve or to be deposited would be different. The composition of the mineral surface would therefore be qualitatively the same, but quantitatively different.

Study Suggested

It may be also that changes in ion concentration at minute distances from solid surfaces are anything but minute, and this would provide further quantitative differentiation between minerals. At any rate, it would seem that selection of conditions to make the spread in surface composition a maximum is a prerequisite for suitable selective flotation of, for example, calcite from quartz.

No one has made as yet determinations of the ionic population at mineral surfaces in flotation pulps; therefore, the picture offered by the foregoing comments is speculative. Yet it offers a field of inquiry that is attractive both scientifically and practically. Perhaps radioactively-tagged atoms could be used; perhaps the polarograph and the spectrograph may prove useful in determining ion concentrations. Compared to the early experiments in flotation theory, such work would entail an extreme delicacy and its

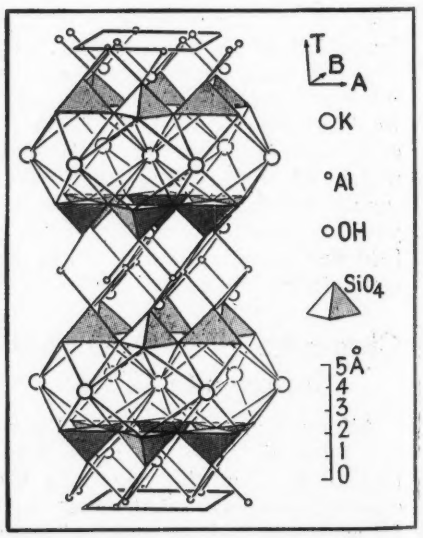


FIG. 2. Layer arrangement in muscovite crystals results in weak bonding between stronger layers, as in multi-deck club sandwich. From Strukturbericht, II, p. 143.

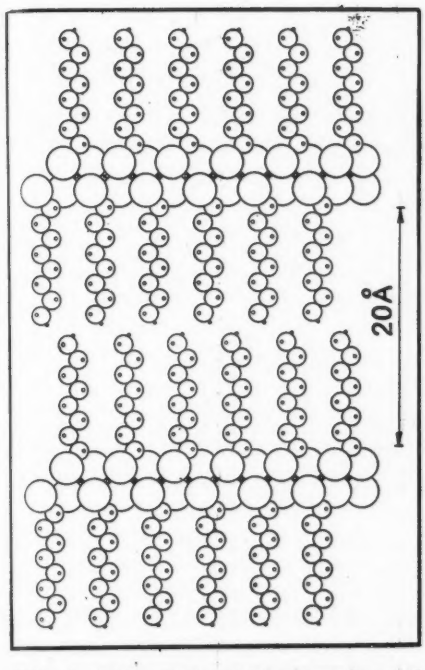


FIG. 3. Fatty acid crystals (caprylic acid represented here) differ from the micas in possessing definite hiatus at intervals. Result is like stack of sandwiches. Large circles shown here are oxygens; small circles are hydrogens; intermediate, are carbons.

execution would require the services of highly skilled physicists and physical chemists.

Making Oxide Mineral Surfaces Adhere to Air

Whatever ions may be present at the mineral surface, however, the mineral will remain water-avid and unflotable so long as the ions are all inorganic. The opportunity for flotation arises only when the mineral has been coated with a hydrocarbon "paint" sufficiently substantial to insulate the water-avid mineral from the water.

Indiscriminate coating with hydrocarbon-chain ions is, of course, of no practical value. The desirable condition is obtained when the concentration of the active ion is such that certain types of crystals are sufficiently hydrocarbon-coated, while others are not sufficiently coated to induce differences in behavior between minerals.

Fatty Acid Structure

Fatty acids typify the sort of reagents that will supply the flotation-promoting hydrocarbon ions. Crystals of fatty acids and of soaps form interesting structures superficially resembling the micas, as is indicated by comparing Figs. 2 and 3. Although both crystals and micas have layer structures, the fatty acid crystals differ in one all-important respect.

Mica crystals are layered arrangements of ions or atoms in which some relatively weak bonds occur in sheets, but there is nothing even remotely comparable to the hydrocarbon hiatus of the fatty acid crystals. A simple analogy will make the difference clear.

A mica crystal resembles a stack of slices of bread each connected to its neighbor by a layer of tacky spread, the whole, in effect, constituting a super club sandwich.

Fatty acid crystals, on the other hand, resemble a stack of sandwiches in which every other slice of bread is attached upwards to another slice. This arises out of the arrangement in the crystals of "molecules" connected endwise, with non-hydrocarbon groups in apposition. The crystals cleave along the zone of weakness where the hydrocarbon chains terminate.

When one of these fatty acid crystals, or for that matter any one of the very many organic layer crystals, breaks up, it presents to the outside world an ordered array of hydro-carbon butts. It is well known that water does not wet surfaces in preference to air. If anything, the preference is for air. To wit, the contact angle (measured across the water) often exceeds 90 deg.; it is 105 deg. in the case of crystals of long-chained paraffin hydrocarbons. Fig. 4 shows the air-water-solid contact for contact angles of 105 deg., 90 deg., 60 deg., and 0 deg. The first three would be flotable in varying degree; the fourth would be non-flotable.

Ionic Competition

In an aqueous suspension of solids, hydrocarbon ions compete for attachment to solid surfaces as do the inorganic ions discussed previously, and the behavior of the solid surfaces will change as the concentration of hydrocarbon ion increases. Fig. 5 shows that the change in character of such a surface is gradual and may be a function of the concentration not only of the hydrocarbon ion but also of the other critical ions.

Of course, the average length of stay of the competing ions at the surface is just as important as the concentration of the various ions in controlling the ion population at the mineral surface. An ion's tenure of a site at the surface will be most strongly influenced by such things as relationship of mass of ion to

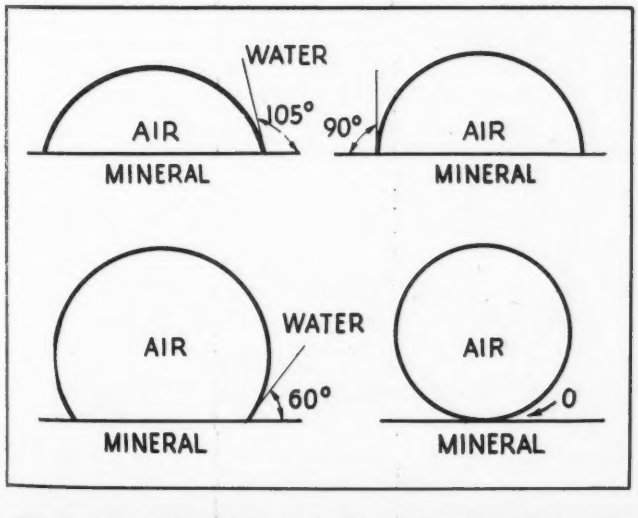


FIG. 4. Air-water-solid contact angle varies according to nature of surface. Zero angle mineral is unfloatable; others exhibit varying degrees of floatability.

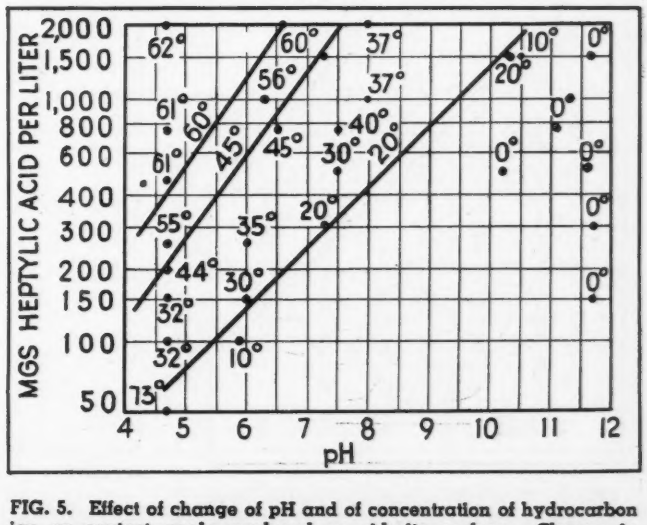


FIG. 5. Effect of change of pH and of concentration of hydrocarbon ion on contact angle produced on siderite surface. Change in nature of surface depends on competition of fatty acid and hydroxyl ions for attachment to surface.

charge, absolute ionic charge, ionic distances, and charges in the substratum.

Effect of Lattice of Mineral Surface

In considering mineral surface coatings of a density beyond that of a very dilute two-dimensional solution, it must be remembered that the sites at which ionic tenure is possible are spaced according to a geometrically defined lattice. If the adsorbed ions can array themselves in register with the lattice of the substratum, a complete coating is merely a matter of providing sufficient concentration of ions. But if the adsorbing ions cannot do so, empty sites are likely to develop and a complete film will not be attained. Or the ions may array themselves in a less-preferred lattice and their site-tenure will be shortened. A study of the common mineral crystal lattices as related to size of flotation collector ions might, therefore, prove fruitful.

For example, consider fluorite and lauric acid. Fig. 6 shows the array of calcium ions in an octahedral face of fluorite, its usual cleavage face. The assumption is made here, for simplicity's sake, that cleavage has parted a plane of calcium ions from a plane of fluoride ions. Actually this would probably not occur, because of the high potential energy of each such plane. Rather each fracture face, after reaching equilibrium in an aqueous solution of calcium fluoride, will possess substantially equivalent numbers of surface calcium and fluoride ions. This would occur if each alternate row of calcium cations in Fig. 6 were omitted, or if the missing calcium ions were arranged in some other fashion, or if the Ca^{++} ions were all in as shown and further coated each by one and only one hydroxyl or fluoride ion.

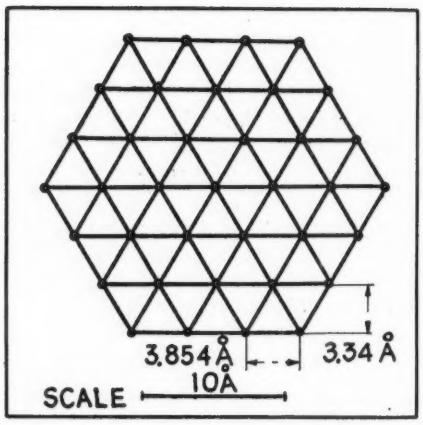


FIG. 6. Position of calcium ions on an octahedral cleavage face of fluorite. To simplify discussion, assumption is made that cleavage has parted plane of calcium ions from plane of fluoride ions.

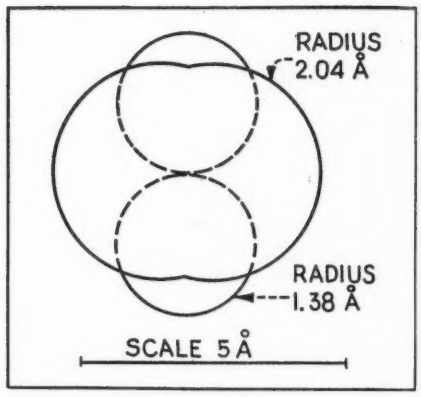


FIG. 7. Cross-section of a laurate ion. Its area (20.8 A) is too great to permit attachment ion-to-ion to the calciums on the fluorite cleavage face.

Ions Must Fit Lattice

But assuming that all the calciums are present in the surface, the area per calcium ion is $3.854 \times 3.34 = 12.97$ Å². On the other hand, the cross-sectional area of a laurate ion is $4.98 \times 4.10 = 20.8$ Å² (see Fig. 7). Clearly it is not possible to find room for as many laurate ions as there are calcium sites, and only one laurate can be provided for each pair of calciums.

This, however, raises the further questions of spacing and electrostatic stoichiometry. The calcium rows are 3.34Å apart. In close packing of laurate, or other fatty acid ions, the spacing of rows is 4.10Å. Clearly the spacing along each row of calcium ions must be increased to permit the rows to come closer together, and Fig. 8 shows that with a spacing of $2 \times 3.854 = 7.708$Å, there is room and to spare to fit the carboxyl ions.

However, the hexagonal array of the calcium ions requires either considerable asymmetry in the bonding of the calcium to the oxygen, or considerable unevenness in spacing the adsorbed ions, or else a different bonding between alternate rows, as shown in Fig. 8.

In respect to electrostatic stoichiometry, the arrangement of Fig. 8 leads to equalization of charge, which is the reason this array appears more likely than one involving asymmetry in bonding or unevenness in spacing. In the equilibrium type of surface, which would have every other row of calcium sites (or its equivalent) blank, if for n calcium sites there are adsorbed $\frac{n}{2}$ carboxyl ions, the number of divalent cations that must also be adsorbed to preserve electrostatic balance is $1/2 \times n/2$. The total number of calcium ions in the surface layer is, therefore, $n/2 +$

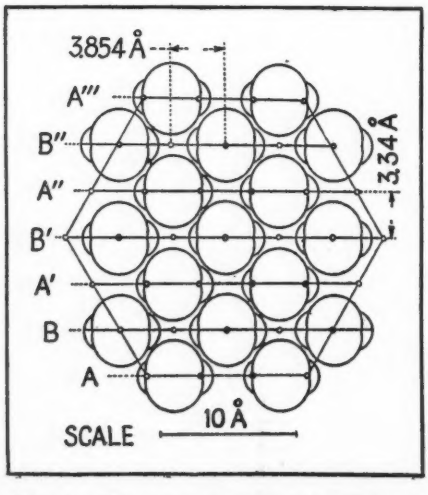


FIG. 8. This arrangement of laurate ions on fluorite fits the large ions in nicely, and also results in equalization of electrostatic charge, although required bonding between ions in alternate rows is different.

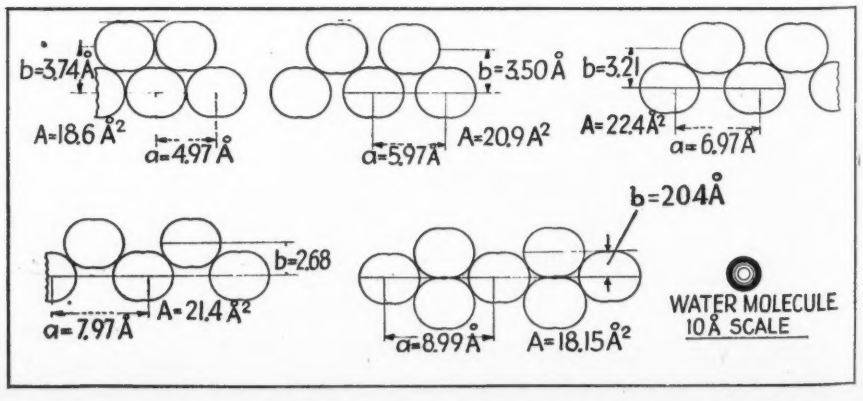


FIG. 9. Hydrocarbon ions may be arranged in these various ways to establish register with tight substratum of smaller ions.

n/4, which is precisely the number of calcium ions called for by the arrangement in Fig. 8. The variety in coordination of alternate-type calciums should cause no concern, for similar conclusions have been reached for several three-dimensional crystals.

This, too, is a subject whose scientific and technological promise warrants further study. A method in use in the Richards Mineral Dressing Laboratories is to fit templates of the adsorbed ions to a lattice of points representing the surface ions of the crystal until a satisfactory array is found. This, of course, proves only that such an array is possible.

Fig. 8, of course, represents an optimum crowding of fatty ions at the surface. Generally speaking, I would expect less properly crystallized adsorbates and more variety in the surface layer.

Fig. 9 shows how the spacing between rows of a tight substratum lattice may still register with a bulkier overlying array providing the spacing along the rows is stretched. In this case the unit ion is the alkyl ammonium ion of lauryl amine hydrochloride.

Let it be assumed, now, that two minerals are present together in a pulp and that both are capable of acquiring collector ions from the aqueous solution. If one of the minerals is more susceptible (perhaps because of a better register of its lattice with the possible lattices of the adsorbate), and if the supply of adsorbate is limited, is it not likely that the collector ions will favor in distribution the mineral of highest register?

For example, if fluorite and quartz are together in a pulp, which therefore contains calcium, hydrogen, fluoride, silicate, hydroxyl, and fluosilicate ions, it is to be expected that at least some of the hydrogens at the quartz surface are replaced by calciums, and that therefore both surfaces can "fix" carboxyl ions. Yet carboxyl ions might well favor the fluorite because it offers ordered distribution of calciums against disordered calciums on the quartz, especially if the spacing of calcium sites is more favorable.

This reasoning brings us to the conception of the *ionic sink*, that is of the existence in any system of a locus that is the preferred residence of any one kind of ion. This ionic sink may be the liquid phase, a surface, or a precipitated solid. All kinds of selections are possible through control of these ionic sinks by judicious addition of reagents, by pH control, desliming, water purification, aëration, and conditioning.

Extent of Surface

In addition to the physico-chemical control just reviewed, two physical phenomena, extent and roughness of surface, are of importance with flotation of all ores, but particularly so with oxidized or non-sulphide ores. The method of physical adsorption, developed by Emmett and his associates at Johns Hopkins University, was applied recently to estimation of surface of minerals by Messrs. Bowdish, Hukki, and Yavasca in pursuing studies in our laboratory on the theory of comminution.

Crushed quartz, all minus-65 mesh, presents a surface of the order of magnitude of 3,000 sq.cm. per gram. In a quartzose sulphide copper ore, say 10 percent sulphides, the sulphide surface may well be of the order of 300 to 600 sq.cm. per gram.

By contrast, coarse deslimed sand-size Florida phosphate has a surface so much in excess of the quartz present as to bring the surface of the mixed sands into the range of 20,000 to 50,000 sq.cm. per gram. Of this about 99 percent is due to the phosphatic half, and 1 percent to the quartzose half.

A black oxide manganese ore has a surface of 155,000 sq.cm. per gram when crushed to minus-65 mesh; 34 percent of this is on the manganese minerals. A flotation-size bauxite was found to have 395,000 sq.cm. per gram, over 200,000 sq.cm. of it on the alumina.

Not all non-sulphides have such immense reagent-consuming surfaces, of course. Apatite, rhodochrosite, and corundum, for instance, have surfaces more in line with sulphides, and they float more like sulphides. The purpose of this comparison is to bring out the crying need for information on this score, not on one ore but on many ores, and not only on the ore but of the flotation and other products made from it.

Roughness of Surface

The neglected factor of roughness of surface also merits study. In one related field, that of wetting or non-wetting of plants and animals, the development of ciliae, fuzz, hair, or feathers is perhaps a consequence of a search by the organism for a structure that will control its water content. In some cases the surface structure is such as to repel water; in others, water is avidly absorbed. The desired result is achieved by combining the

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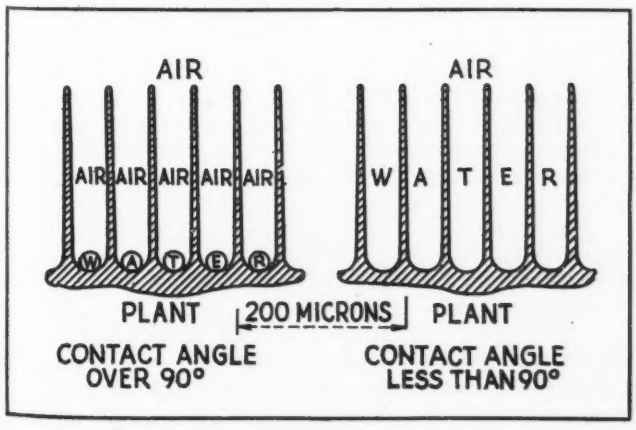


FIG. 10. On surface of tapering ciliae, high contact angle at left results only in droplets of water at base of hairs; hydrocarbon coating would produce this effect. Low angle results in complete wetting, as at right.

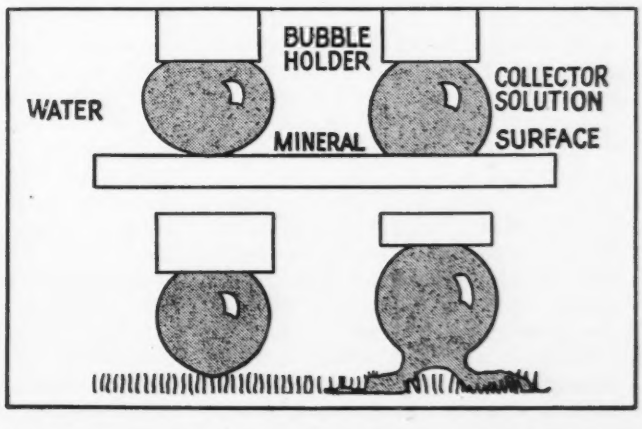


FIG. 11. Upper figures show contact angle established by captive bubble on non-flotable and floatable flat surfaces. (After Wark.) Lower figures show captive bubble in contact with 200-mesh copper screen immersed in dilute solution of amyl xanthate. Contact is greatly aided by addition of hydrocarbon oil.

Mexican Mining Must Have Tax Relief

This candid statement by one of Mexico's most eminent mining engineers is of interest to all our readers whether they are particularly concerned with Mexican problems or not. There are but few, if any, mining countries whose mining industry is not similarly handicapped in some degree and whose governments could fail to profit by heeding Sr. Perez Duarte's advice. The Editors

CONSTANTINO PEREZ DUARTE,* Mining Engineer

RECENTLY, the Mexican Chamber of Mines presented to the Secretary of National Economy an interesting study of the mining situation. People devoted to mining have been worried for a long time, not only because of the present critical situation, but particularly over its unpropitious future.

Concurrently with this study, I was invited to express my ideas on the mining situation. This I am glad to do as a matter of duty. Even though I may criticize policies now in effect, my desire is to give a true analysis of conditions and to make constructive recommendations, in order to assist those who are charged with administration of the nation's economy toward finding appropriate remedies.

Any observer of the Mexican economy knows that for centuries it has depended almost exclusively on mining, particularly on silver mining. This truth is reflected in the common proverb: "In Mexico, when silver rises even the burros have value."

At the time of the Spaniards, the creation of population centers, the construction of roads, the birth and development of agricultural areas, were intimately related with the erection of "reales de minas" (mining towns) and with the silver bonanzas therein; from these bonanzas wealth was created, sumptuous churches and luxurious mansions were erected, and there were created many nobiliary titles.

When Mexico became independent and many Spanish businessmen abandoned the country, a profound decline in mining developed, until, invited by the noted statesman Lucas Alaman, European capitalists, particularly English, were attracted by Mexico's legendary wealth and again put many mining camps back into operation. Subsequently, during the time of General Diaz, when a policy of ample protection for investors was observed, several means of communication were constructed, particularly railroads, and American capital came in large amounts to develop the mining industry. Several metallurgical plants were established, which permitted the utilization of mineral products that were difficult to treat by older methods.

Mining is definitely declining; before it can be revived, certain guarantees must be provided. Investors must enjoy reasonable protection and must be given a chance to earn profits commensurate with risks taken.

In those times, during which uncounted sums were invested, some operators were able to make big fortunes. These were the most fortunate of those who were technologically prepared. In a great many cases results were adverse to the investors; however, Mexican economy has always benefited from ample investments, which have been principally of foreign capital.

At present the picture is completely different. From the study made by the Mining Chamber I take some figures which reveal an alarming state of decline.

Some companies, either because of their greater financial resources, the importance of their deposits, or the nature of their ores, have treatment plants, especially cyanide plants, annexed to their mining operations. However, the big majority of the so-called small miners depend for a market upon the smelters established in San Luis Potosi, Monterrey, Torreon, and Chihuahua. Thus, we are able to judge the condition of the small mines from the number of shippers to said smelters, as well as from the total tonnage of ore delivered by them. (See table).

Comparing 1937 and 1944, we find that in seven years the number of shippers was reduced from 843 to 382, or by 55 percent. In the same time the tonnage of ore decreased from 1,309,643 tons to 904,041 tons. In the year 1941 we find a tonnage figure more or less the same as in 1944, but produced by 724 shippers, or twice as many as those recorded in 1944. This indicates the tenacity of the group that persisted despite adverse circumstances. Nevertheless, their number was reduced 50 percent in the three years 1941 to 1944. It is also noteworthy that in 1943 and 1944, when the number of shippers decreased,

*This article, freely translated herewith, originally appeared in "El Economista," Mexico, D.F.

the average tonnage per individual increased. This indicates that the casualties were principally among the smallest operators.

Coupled with the foregoing considerations, we see that the production of gold and silver was reduced from 1940 to 1944, gold from 28,182 kilos to 18,614 kilos, a reduction of 45 percent, and silver from 2,684,063 kilos to 2,022,207 kilos, a decrease of 22.7 percent. To estimate the importance of the preceding figures, it must be realized that during the past few years the production of strategic metals was intensified. These metals are usually associated with gold and silver. Had it not been for this forced production, the decrease in production of these two precious metals would have been even greater. It must be realized that almost all the abovementioned decreases were at the expense of small Mexican miners with little financial resources. In fact, there abound names of companies operating on a small scale that have shut down because of the pressure of adversity. There come to my memory some names like Maguarichic, Las Coloradas, Pinos, Guadalupe de los Reyes, La Chiripa, Teojomulco, and many others to which list there must be added an uncounted host of miners that operated as individuals or partnerships.

Large Companies Included

From this incomplete enumeration of small mining casualties, principally representing Mexican capital, we pass on to the larger companies. Here we also find that during the past 30 or 40 years an important number of companies have ceased their activities, either by actual shutdown of the mines or by handing the properties over to cooperatives. The latter, because of financial, technical, or administrative inadequacy, led an extremely precarious life. Those that subsist are able to do so only by official grace in the way of tax exemptions or more direct assistance. We can list all the companies operating in the district of El Oro and Tlalpujahua, such as the El Oro Mining & Ry. Co., La Esperanza, Tiro Mexico, Oro Nolan, Dos Estrellas, and Borda Antigua. In the Pachuca district are Santa Gertrudis, Dos Carlos, San Rafael, Maravillas y San Francisco, Metalurgica de Atotonilco el Chico, and other companies of less importance. In the State of Guerrero I remember the names

Shipments to Smelters

Year	Number of Shippers	Tons	Average Tonnage Per Shipper
1937..	843	1,309,643	1,553
1938..	807	1,127,473	1,397
1939..	835	1,116,444	1,337
1940..	788	1,151,667	1,462
1941..	.724	998,316	1,379
1942..	760	1,081,092	1,422
1943..	655	1,115,385	1,703
1944..	382	904,041	2,366

of the Chontalpan and Xitinga; in Sinaloa, the Cia. Minera El Tajo, at Rosario; in Nayarit the name of Huicicila; in San Luis Potosi the Cia. Minera Kildun; and several others in various states.

Other companies which are still operating in the Republic openly speak of their bad situation, which makes them anticipate cessation of activities in the near future. These are the Cia. Minera El Boleo, in Baja California, and the Potosi Mining Co., in Chihuahua. Others that in a somewhat longer period also see their future seriously menaced include the very important mines of Fresnillo, in Zacatecas, and those of the Cia. Real del Monte y Pachuca, at Pachuca.

The superficial observer may no doubt argue that the foregoing situation need not surprise anybody, as the mining industry is exhaustive and thus its activity is only temporary; therefore, the work suspensions mentioned do not constitute anything more than a part of the natural cycle of mining. This is true to a great extent, but in an unexplored country like Mexico it should be expected that when a mining unit becomes exhausted, other mines or mining regions will sprout, either in areas known to be mineralized but not sufficiently explored, or in new regions.

Such substitution of exhausted mines has not taken place, as new discoveries are very few and none of them is comparable in importance to those that formed the mining tradition of our Republic. From the present scale of operations, the exhaustion of known mining reserves may be forecast for the near future.

Examination of the foregoing picture invites us to study the causes of such a radical change in Mexico's once vital industry, which still contributes a prominent part of the value of Mexican exports.

It is well known that investment in the mining industry is inherently risky, as success depends to a great extent upon factors which cannot be predetermined accurately. Thus, mining districts all over the world show remains of large investments with negative results. Unfortunately, these failures represent the majority; however, there are also examples of ventures which obtained rich reward from the depths of the earth.

Had there never existed the opportunity to obtain great rewards in case of success, undoubtedly the great bulk of the mining wealth of the world would remain unexplored. There are innumerable other activities, the outcome of which is easy to forecast and in which the investor can be reasonably sure of success, if he must content himself with a modest return.

From the foregoing, it should be perfectly clear that, for the adequate development of the mining industry, it is necessary to create for it sufficient legal guarantees to provide not only the possibility of a painful sacrifice of effort, illusions, and material interests, but also to assure a chance to realize an ample and effective reward. Otherwise, there will not be suitable incentives to undertake the risks of mine development.

Three Adverse Factors

The conditions under which our mining industry is struggling at present are entirely opposed to the desideratum pointed out in the preceding paragraph. The worst of these adverse conditions are due to legislation pertaining to mining. Inasmuch as legislation is created by the will of man, it is possible to change the law and alter the adverse environment in which Mexican mining is being strangled.

The legal provisions to which I refer are of three types: (1) general mining legislation; (2) fiscal legislation; (3) labor legislation.

With respect to the first, this has been converted, from a well thought out code, simple and liberal, into a conglomeration of complicated rules which are confusing and subject to different interpretations. As a result, nobody has confidence in the validity of concession titles or of the titles to mining properties. This matter is so vast and important that I wish only to point it out at this time, as the subject deserves special study.

Labor legislation, and, further-

more, the interpretations and customs that have developed from it, constitute a very serious and particularly insurmountable obstacle for the real development of mining. The nature of mining demands special legislation which takes into account its particular conditions. However, I am only mentioning the problem, as its extent and importance call for careful study.

At present I wish to consider only the heavy taxes that are imposed on the mining industry. These are so high that they in themselves constitute a serious obstacle to success in mining.

The prinicipal taxes directly affecting mining are: (1) property tax or mining concession; (2) production taxes; (3) "Aforo" or export tax; (4) income tax.

Mining Property Tax

Up to 1892 the basic condition for the exploitation of any mine was the maintenance of continuous work, subject to public vigilance, by those interested, for which private individuals had the right of "denouncement" against those who did not carry on continuous operations. This public right to denounce caused many difficulties, which it was desired to offset by creating a surface tax or tax on mining property, a substitute for the obligation of continuous operations; periodical payment that could be considered as rent. In the present legislation, this tax on mining property is still imposed, with higher figures than those originally in effect. Furthermore, the obligation to maintain continuous work has been re-established.

Although the surface tax is not very high, it does result in a duplicated obligation, for which reason the legislators should decide which is the most convenient procedure in the public interest, the obligation to perform assessment work or a fixed rent, and enforce only one of the two alternatives.

At the time of the Spanish crown, it was considered that the king had the right to substantial participation in the finding of treasures, mines being classed in that category. At that time there could often be found, in recently discovered America, outcrops of gold and silver veins with values in sight which produced immediate wealth, because, in addition to the resource itself, the discoverers could find cheap labor for their operations. Thus, the imposition was considered a royalty for the king on mining products, the same as for treasures. This participation was known as "the king's fifth," as it consisted of one-fifth of the gross value. During the same viceregal epoch, it was estimated that the tax was an excessive burden on the miner, and the rate was reduced, first to one-half and then to one-fourth, although it continued to be called "the king's fifth."

In Mexico's independent life the principle was preserved that the successor to the king, or the nation, should receive a portion of the gross value of the metals extracted from the earth, reducing the rate of tax to 2 percent of the gold and silver, without collecting anything for the other metals. This principle has continued in effect, although varying, and always increasing, the tax rate. At present this amounts to 9.9 percent on gold and 7.7 percent on silver. Also, in smaller percentages, but without exception, the tax applies to all other metals and metallic compounds.

As stated, the principle has been maintained unaltered. Logically, then, the theory surrounding the royalty tax should also have been preserved. In demanding a fraction of a discoverer's reward in behalf of the king, the crown forswore all right to impose added taxes on possession of the resource.

Income Tax

In modern times, as taxation became more or less of a science, we arrived at the just principle that the most equitable tax is one levied on profits or income derived from human activities. Thus there was established the "income tax," which endeavors to be truly proportionate to the net profit of the taxpayer.

The mining industry did not escape from this modernization of the tax structure, and, in common with practically all other industries, pays taxes on its net profits. The nature of the industry makes it difficult to establish simple rules for the application of this tax. Especially with regard to the classification of investments, amortization, and depreciation, the law has serious defects which constitute real offenses against equity. However, what in principle is really worse than inequitable application of income taxation is the circumstance that payment of the production tax, the modern prototype of the "king's fifth," ought to save the taxpayer from payment of further imposts devolving from his ownership of the mineral resource.

To preserve the theory surrounding imposition of a tax which originated in colonial times and under rule of a monarch may be considered invalid today. However, the theory is altered, the structure should be modernized without retaining the primitive burdens. To do otherwise is to discriminate against the mining industry. No other industry is so absurdly burdened with heavy taxes that are based on such different principle.

Production Tax Unfair

Undoubtedly the tax which is most justified, as has already been said, is the tax on profits. For this reason, if it is desired to be fair to the mining industry, the production tax ought to be abolished completely, preserving the income tax but modifying it in consonance with conditions peculiar to mining. Let us have a colonial system or modern tax structure but not one superimposed on the other!*

The measure I advocate would constitute effective assistance to the mining industry, but in no case should this be considered as a gratuity. It should be considered as recognition of an error which has lasted for many years and is a serious obstacle to healthy development of Mexico's mining industry.

In 1938 our currency suffered considerable depreciation with respect to United States currency, and the finance authorities estimated that, due to the difference in the rate of exchange, Mexican exporters would obtain a profit, not earned, in converting money at a rate different from the normal. Thus, the so-called "Aforo" tax was established, which is really an export tax. This impost was applied to mining products.

In this application we again find an unjustified generalization that fails to consider taxes in effect on the different metals. Thus, in the Mining Tax Law we find that the percentage of taxes on the silver, copper, and lead follows an increasing scale in relation to the price of the metal in Mexican currency. Now, the increase in the Mexican currency value of these metals can

*Editor's Note: (Also worthy of consideration is the fact that the "treasure" type of easily discovered and worked bonanza belongs to history. The finding of new orebodies today is not a privilege that ought to be taxed, but a hazardous service that ought to be rewarded.)

Tax Reform Needed

Summarizing, I believe that if it is desired to avoid a collapse of our basic industry, it is necessary to proceed, without delay, to the study and promulgation of measures that will really stimulate investments in mining, creating an atmosphere of security and justice so that investors may face the risks of mine development with a reasonable chance for profit.

As part of the program, with regard to taxes, all those which are a burden to the industry should be studied, especially as follows:

1. To choose as requisite for retaining mining rights either the system of assessment work or the payment of a tax in proportion to the surface covered.

2. To repeal production taxes because they are obsolete.

3. To repeal the "aforo" tax because the reasons for which it was established no longer exist.

4. To make a careful study of the income tax law in order to make its application simple and equitable.

People who are indifferent to what extent taxation weakens the organism which sustains it will find my propositions ridiculous, as the national budget would be deprived of considerable immediate income; however, considering that we fortunately have in our financial spheres persons who are well educated economically, I hope and trust that they will give these measures mature consideration and realize their full import.

occur only for two reasons, either because of an increase in world prices of metals or because of a depreciation of Mexican currency in terms of foreign exchange. Therefore, the Mining Tax Law had already nullified any advantage which the mine operator could have obtained from a variation in the rate of exchange. Notwithstanding this, the aforesaid "Aforo" tax law was applied to all metals.

This "Aforo" tax law, as has already been stated, was based on presumption of an advantage obtained from exporting any product. Another law prohibited exportation of gold, which had to be sold to the Bank of Mexico; that is, the essential condition for creating the tax—namely, the exportation—was not realized. However, the tax was levied, although subsequently, and probably to avoid legal complications, its name was changed to that of Emergency tax. This tax amounts to 10 percent, which, added to the production taxes, brings the total tax amount to 20 percent of the gross value. In short, the original "king's fifth" was reinstated to its full anti-economic extent.

During the last week of December 1944 a decree was promulgated establishing a subsidy for gold and silver mines, consisting of the total original "Aforo" tax for the gold and of $3.18 pesos per kilo of silver.

Outside of the strange manner of recognizing original errors, in the form of a subsidy or favor, up to the present the decree in question has served only to increase the number of annoying steps and troubles for the affected companies, as for one reason or another practically none of the subsidies in question have been paid.

In order that the mining industry may feel that it is enjoying a real right and not a mere situation which is humiliating and easily revocable, the "Aforo" tax should be repealed for all products of the mining industry. For the reasons given in the foregoing the tax has no justification; also, with the increases in the cost of all kinds of supplies and wages, the supposed advantages derived from the devaluation of our currency have been nullified.

As has already been said, mining is rapidly moving towards a total collapse. Therefore, if constructive measures are not adopted in a more or less short period, this item of income will be seriously affected. It is necessary to study the problem courageously, as it may be better to decrease the income voluntarily than to lose it entirely.

Benefits to Nation

In fact, the development of the mining industry is reflected economically in different ways, tax revenue being only one.

Of the total value of metal production a great portion is spread throughout the Republic in the form of salaries and values of domestic materials, amounts which, spreading in concentric circles whose value and extent are difficult to determine, produce taxes and afford employment to important segments of the population. A small part of this value goes abroad in payment for machinery, materials, and other implements, and another portion, even smaller, also leaves the country in the form of profits for foreign investors. However, the extent of this percentage has always been exaggerated. In reality it is of minimum importance, as the distribution of profits abroad serves as an advertisement for Mexican industry and stimulates entry of capital for new activities. Finally, metals constitute our principal type of export. If weakened, a real crisis would be provoked in our trade balance.

The foregoing explanation provides enough evidence to justify a reduction in current tax income, but there is still more: the tax loads constitute an element in production costs. For the logical utilization of any ore it is an express condition that the recovery of its metals must pay at least the total costs, leaving underground the ores which are too low-grade to use. If an element of costs as important as is represented by the reforms I propose were eliminated, the tonnage of ore now unusable which could be mined would be proportionately increased. In other words, these reforms would lead to the utilization of many millions of tons of ore which now remains, for the benefit of no one, in the ground. The exploitation of this ore would probably compensate for the apparent fiscal sacrifice referred to.

The economic and political authorities of Mexico are faced with an unavoidable dilemma. They must either face patriotically and courageously the difficult situation of the mining industry, and create a proper environment for its profitable development, or see its collapse.

Rubber-Lined Pipe Resists Abrasion in Mill Circuits

JAMES CASALE, Assistant Mill Superintendent, Balmat Mill, St. Joseph Lead Co., Balmat, N. Y.

PRACTICALLY ALL ORE dressing plants require a certain amount of pumping of pulps varying in abrasiveness. In differential flotation plants, the problem is further complicated by the necessity for recirculating intermediary products. In some plants the pumping problem is complicated by the treating of a larger ore tonnage than that for which the mill was originally designed. Installation and maintenance of pumps and pipe lines in such plants may be costly and require considerable repair.

The Balmat Mill of the St. Joseph Lead Co., Balmat, N. Y., situated on a medium steep slope, is a differential flotation plant making lead, zinc, and pyrite concentrates. Originally designed to treat 500 tons of ore per day, the present tonnage treated varies from 1,000 to 1,250 tons daily. Operating and maintenance costs on pumps and pipe lines were substantially reduced by the use of spiral-welded rubber-lined pipe and rubber-covered pump parts. Previous to the installation of spiral-welded rubber-lined pipe, repairs and replacements were made at the end of each operating week somewhere along each of the major pump lines.

Experience at Balmat Mill has indicated a service life of five years or more for spiral-welded rubber-lined pipe, compared with an average service life of two months for wrought-iron pipe. With rubber-covered pump parts we have found that 300 lb. of rubber per year is equivalent in service life to 18.8 tons of alloy cast-iron pump cases and follower plates per year. The performance of rubber-covered pump parts is excellent, but the performance of rubber-lined pipe is nothing short of astonishing.

Following is an account of the performance of spiral-welded rubber-lined pipe and rubber-covered pump parts in three major pump circuits in Balmat Mill.

Pump and Line No. 3

This 6-in. pump line transports lead flotation tailings, zinc middlings, and zinc primary tailings to the zinc flotation conditioning tanks. Spiral-welded rubber-lined pipe was installed in this line on Feb. 28, 1937, and is still in use, no replacements having been made since the original installation. Wear of the rubber lining is negligible. The one bend in this line is made of Goodyear wrapped-fabric flanged rubber hose.

Rubber-covered pump cases lasted an average of 375 days in operation, compared to 150 days for alloy castiron cases. Of the various rubber compounds tested, the best gave a pump-case lining life of 600 days. In Pump No. 3A, which is a 4-in. helper pump for No. 3 pump, rubber-covered cases lasted an average of 148 days, compared with 56 days for alloy castiron and 30 days for steel cases.

Table I. Comparison of Weights of Wrought-Iron Pipe and Spiral-Welded Rubber-Lined Pipe

	Standard Wrought-Iron Pipe		Spiral-Welded Pipe	
Pipe size, inside diameter	6 in.	4 in.	7 in.	5 in.
Weight, pounds per lineal foot	18.97	10.79	8.78	4.58
Weight of ¼-in. rubber lining, pounds per lineal foot	....	....	2.94	2.12
Total weight, spiral-welded rubber-lined pipe, pounds per lineal foot	....	....	11.72	6.70

Note: 7-in. spiral-welded pipe with ¼-in. rubber lining used in place of 6-in. wrought-iron pipe. 5-in. spiral-welded pipe with ¼-in. rubber lining used in place of 4-in. wrought-iron pipe.

Pump and Line No. 4

This 4-in pump line carries pyrite secondary cleaner tailings to the pyrite primary cleaner cells. Spiral welded rubber-lined pipe was installed here on March 3, 1937, and was entirely replaced on July 5, 1942. This represents an operating life of 1,604 days. High pyrite content of the pulp makes a very abrasive pulp. Nevertheless, the replacement of this line was due more to rusting and deterioration of the spiral-welded pipe than to wear of the rubber lining. With the rusting and weakening of the metal pipe, there was no stiff metal backing to withstand the hydraulic pressure in the line. Rapid deterioration of the rubbing lining followed. Consequently relatively thin metal walls of spiral-welded pipe must be very carefully and heavily protected with corrosion-resisting paint. When holes or weak spots have developed in the spiral-welded pipe through rusting, an outside patch consisting of a rubber sleeve backed up with a metal sleeve tightly clamped around the pipe at the weak spot, is made.

Rubber-lined pump cases lasted 345 days, compared with 61 days of operating life for alloy castiron cases. Rubber-lined follower plates lasted 356 days, compared with 58 days for alloy castiron follower plates.

Pump and Line No. 5

This 6-in pipe line transports zinc scavenger flotation tailings, pyrite middlings, and pyrite primary cleaner tails to the pyrite flotation conditioning tanks. Spiral-welded rubber-lined pipe was installed in this circuit on March 6, 1937. One 20-ft. length of rubber-lined pipe was replaced on March 8, 1942; otherwise the original line is still in top operating condition. The bend in this line is made with wrapped-fabric flanged rubber hose.

Rubber-lined pump cases averaged 544 days of operating life, com-

pared with 41 days for alloy cast iron. In Pump No. 5A, a 4-in. helper pump for No. 5, rubber-lined cases averaged 195 days in operation, compared with 42 days for alloy cast iron.

In the original mill testing of rubber-lined pipe, a 4-in. wrought-iron rubber-lined pipe was used instead of spiral-welded pipe. When the value of rubber-lined pipe became apparent, spiral-welded pipe was used in place of wrought-iron pipe because of the reduction in metal weight and consequent ease and speed of installation and maintenance. Table I compares weights of spiral-welded rubber-lined pipe with those of wrought-iron pipe. One disadvantage of the spiral-welded pipe is the relative thinness of walls (12 to 14 gage), which requires heavy paint protection from rust and corrosion.

When rubber-lined pipe was first installed, the lines were turned over one-quarter turn every four months to equalize the wear on the lining. This was discontinued when no appreciable wear was observed in the rubber lining after several years of service. Occasional bad spots in the rubber lining are repaired with a vulcanizing patch if the bad spot is within reach from one or the other end of the pipe, but this vulcanizing repair is a minor maintenance item.

Long Life Indicated

It is interesting to note that the original 4-in. wrought-iron rubber-lined pipe tested in the mill during 1936 and 1937 is still being used in the mill and is giving excellent service in a number of pump circuits. This original rubber-lined test pipe is at present being used in No. 6 Pump Line, a 4-in. line transporting zinc rougher concentrate and zinc secondary cleaner tailings; in No. 5A Pump Line, a helper line in the No. 5 pump circuit; and in the long sweeping bend of No. 13 Pump Line, which carries a coarse and highly abrasive rod-mill product to the lead flotation section.

In ordering spiral-welded rubber-lined pipe, exact specifications as to diameter and length are obtained from the engineering office files. The spiral-welded pipe is shipped by the manufacturer, the Taylor Forge & Pipe Works, at Chicago, Ill., direct to the Goodyear Tire & Rubber Co. plant at Akron, Ohio, which, after applying the rubber lining, ships to the Balmat Mill.

The use of rubber-lined pump parts was developed in cooperation with the Goodyear Tire & Rubber Co. A series of special abrasion-resisting rubber compounds was tested for wearing life in pump service. Figures reported above as average operating life for pump cases include results obtained with all types of rubber compounds, inferior ones as well as those giving top performance. Erratic and subnormal life of rubber lining is obtained when the lining of cases is defective. This is particularly true when what appeared to be air bubbles were entrapped in the lining. The longest life of rubber lining in pump cases is obtained when they are inspected carefully at the end of each operating week and small pits and bruises in the lining smoothed over with plastic rubber or plastic cement. Experience shows that a rubber-lined pump case or follower plate may be rubber-lined four or five times before it has to be discarded. Rubber-lined follower plates were equally successful in service as rubber-lined pump cases. No rubber compound was found which gave satisfactory service as a lining for pump impellers.

Table II. Weight of Alloy Cast-Iron Pump Castings and Rubber Required to Line Pump Castings

Pump Casting	Weight of Alloy Iron Casting	Weight of Rubber Required to Line Casting
4-in. pump case	365 lb.	18 lb.
4-in. follower plate	74 lb.	4 lb.
6-in. pump case	588 lb.	27 lb.
6-in. follower plate	155 lb.	5.5 lb.

Alloy cast-iron cases and follower plates are purchased locally and sent to the Goodyear's Akron, Ohio, plant for application of the rubber lining. Table II gives the weights of 6-in. and 4-in. pump cases and follower plates and the weights of rubber required to line them.

Other rubber products in use for pumping and transportation include two short lengths of 6-in. heavy-duty rubber hose used to make a 90-degree bend and connection between the final tailings pump discharge and the wood-stave tailings disposal line.

The use of spiral-welded rubber-lined pipe at Balmat has enabled us to make a noteworthy saving in the operation, maintenance, and repair of pipe lines carrying abrasive pulps. Most of the rubber-lined pipe has been in service eight and nine years and is still in excellent operating condition. We find little repair and maintenance has to be done on installed rubber-lined pipe.

Efficiency of operation has also been increased by a virtual complete elimination of spillage due to leakage of ore pulps through pipe joints and holes which were frequently worn in the previously used wrought-iron pipe. The practical differential flotation mill operator will best appreciate this elimination of spillage, which entails the washing into and collection of spillage in sumps and a periodic return of spillage to the mill circuit, with the consequent disturbing of a delicate flotation balance between three separate flotation circuits.

Results Are Excellent

Although the savings achieved by use of rubber-lined pump parts have not been as spectacular as those achieved with rubber-lined pipe, we nevertheless consider them to be excellent. Calculated on an annual basis, 300 lb. of rubber are equivalent in service life to 18.8 tons of alloy cast-iron pump cases and follower plates. Thus one pound of rubber is equivalent to 125 lb. of alloy cast iron. When the factor of the cost of handling and changing heavy iron pump parts is taken into consideration, it is easily seen why we are enthusiastic about rubber linings for pump cases and follower plates at Balmat.

After the supply of natural rubber for pump linings was cut off because of the war, a number of test runs were made using synthetic rubbers of several varieties as lining for pump cases and follower plates, but none even approached the performance of natural rubber. We are looking forward to a return of a plentiful supply of natural rubber to continue further our work with rubber-lined pump parts.

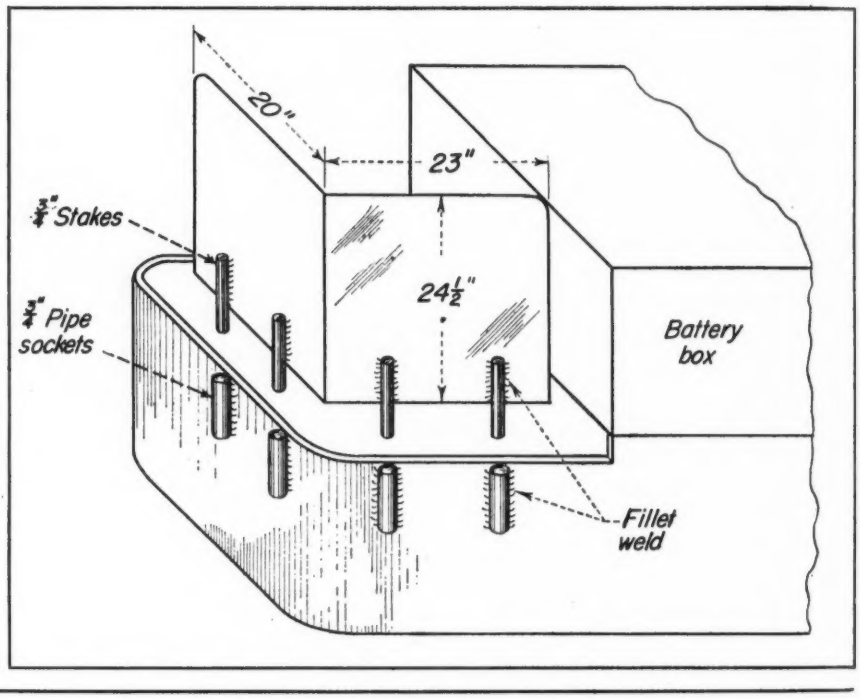
Acknowledgment is made to J. J. Burns, mill superintendent, Balmat Mill, St. Joseph Lead Co., who made many helpful suggestions and edited the data here presented, and to R. J. Mechin, manager, Edwards Division, St. Joseph Lead Co.

OPERATING IDEAS

Safety Shield Protects Locomotive Operator

Every locomotive is equipped with a safety shield before it is sent underground for service at the Wright-Hargreaves mine, Kirkland Lake, Ontario. As illustrated, the shield consists of a bent sheet of 3/16-in. plate to which short ¾-in. steel stakes are welded. Four short lengths of ¾-in. pipe are welded to the frame of the locomotive and serve as sockets in which the stakes are set when the shield is mounted.

This protective device has demonstrated its value on several occasions by preventing injury to the locomotive operator, according to W. Smith, mechanical superintendent, who submits the idea. The shield prevents the operator from scraping his arms against the walls of narrow drifts, and wards off any objects which might project from a car while it is being coupled to the locomotive.



Basic Principles Controlling Chute Design

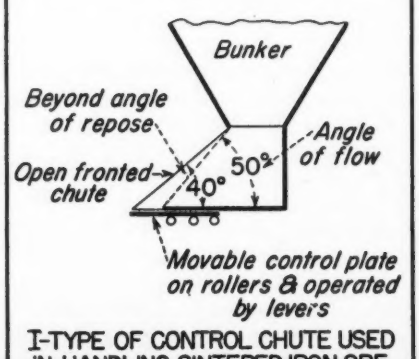
Several principles which have been used to overcome difficulties in handling materials through chutes are herewith presented by P. Collins, of Hough Green, Widnes, Lancastershire, England, who observes from experience that improperly designed chutes and hoppers have often seriously reduced output.

Three designs of chutes, handling three widely different materials, are shown. Each chute has an entirely open front, so as to be free from choking. Control of flow is obtained by observing the useful law that there is an angle at which a given material will commence to flow, and one at which it will again become stationary.

As behavior of material varies with moisture content, it is essential that a chute design incorporate flexibility.

The original chute for Installation No. 1 wore out continually because of abrasion. This was corrected by mounting a movable control plate as shown. When the control plate is drawn backward, material begins to flow because the angle from the bunker throat to the edge of the chute bottom (50 deg.) is steeper than the angle of repose of material. Flow is stopped by pushing the control plate forward. Advantages of this design are:

1. Choking is positively eliminated if maximum angle of flow is made sufficiently steep.



I-TYPE OF CONTROL CHUTE USED IN HANDLING SINTERED IRON ORE

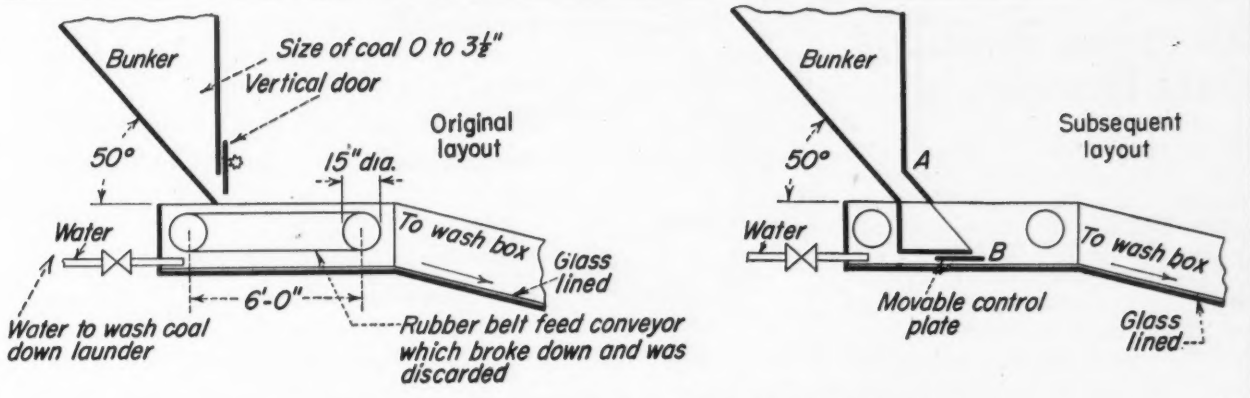
2. Wear is greatly reduced because material flows over a bed of dead sinter formed in the corner of the chute.

3. The chute is easily operated with a suitable combination of levers for local conditions.

Installation No. 2 shows a layout which was adopted for overcoming a breakdown on a feeder belt to a coal washery. Here, again, principles mentioned in Installation No. 1 were utilized. The movable control plate was held by bolts in slotted holes which could be drawn tight after desired flow from the bunker was obtained. Removal of the vertical door eliminated choking troubles entirely.

The third installation was used on a 500-ton bunker discharging into mine cars.

The mine was open cast, and when moisture was present the ore became very sticky and constant poking with long bars was necessary to get it through the chutes. To overcome this difficulty, the opening in the bunker front at the

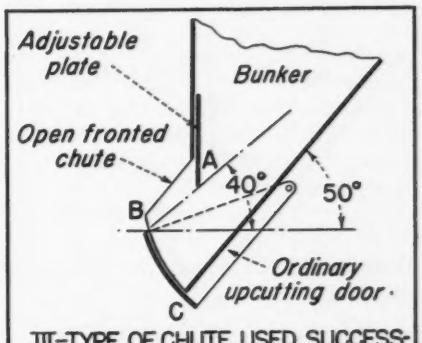


II—SKETCH SHOWING REPAIR ADOPTED DUE TO FAILURE OF FEEDER BELT

throat of the chute was considerably increased in depth, and the sides of the chute were increased in height to meet the larger opening. A heavy adjustable plate with studs welded to it was fitted as shown, with the studs protruding through slots in the bunker front. It was found in practice that only a few minutes were needed to loosen the nuts holding the plate in position and adjust to whatever angle of flow was necessary. In operation, it is important to set the plate to just the required flow, as otherwise it is possible, under free-flowing conditions, to have such a large opening that the door cannot be shut against the stream of material.

Mr. Collins is of the opinion that this simple principle can solve a lot of handling troubles where ores with these variable conditions are encountered.

The ease with which control plates may be adjusted in these designs is especially desirable because the physical character of materials handled through chutes changes appreciably with the variable condition in most operations.



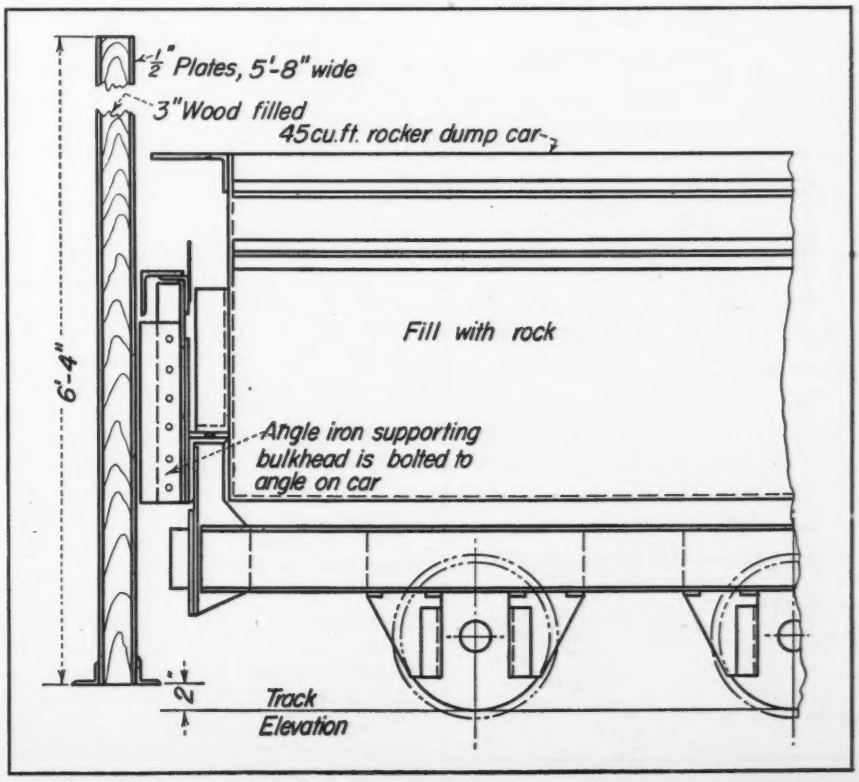
III—TYPE OF CHUTE USED SUCCESSFULLY ON IRON ORE, 12" LUMP AND SMALLER

Portable Bulkhead Saves Clean-Up in Headings

Mining crews have used the illustrated portable blasting bulkhead to prevent muck from flying from headings at the Lake Shore mine, Kirkland Lake, Ontario, according to George Purdie, mechanical superintendent, who submits the accompanying sketch.

The bulkhead consists of two ½-in. plates with a 3-in. wood filler mounted on the front end of a standard 45-cu.ft. rocker dump car by means of two angles which fit against the legs of two angles on the car frame. The bulkhead is 6 ft. 4 in. high and 5 ft. 8 in. wide.

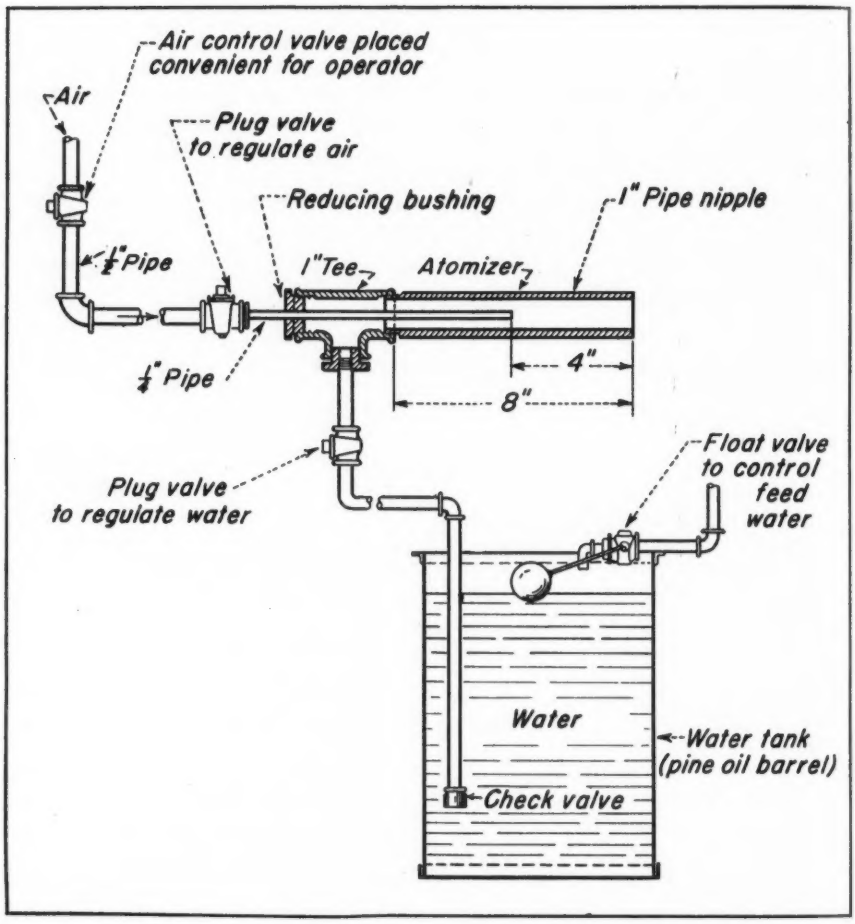
Workmen who use the blasting bulkhead are highly pleased with it because it saves cleaning up "fly dirt" from the drift before mucking operations can be started. Originally the bulkhead was placed 15 ft. from the face during blasting, but miners state that they have placed the bulkhead as close as 12 ft. with good results. The car is filled with rock, and muck is placed behind the wheels to prevent the car from moving during the blast.



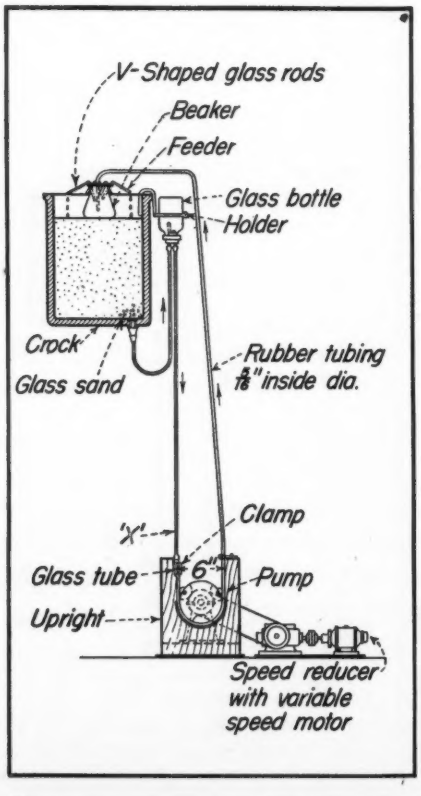
Atomizer Reduces Dust Hazard

Referring to the atomizer unit here shown, which was used successfully at the Eagle-Shawmut concentrator near Chinese Camp, Tuolumne County, Calif., C. A. Kerr, mill superintendent, writes: "We have had a serious dust problem at our crushing plant, and although several schemes were tried, the difficulty was not overcome until adoption of a spray unit employing nozzles with small holes. These atomizers worked well, but failed when dust particles clogged the nozzle holes. The frequent cleaning required discouraged operators who had to use them. Additional experimentation led to the development of the simple spray arrangement here shown, which, because of the satisfactory service it has given, may be of interest to others."

All component parts are identified in the accompanying assembly drawing. Note the valves installed to control operation, regulate air feed, and regulate water introduced in the atomizing chamber.



Ingenious Pump Circulates Leaching Solutions



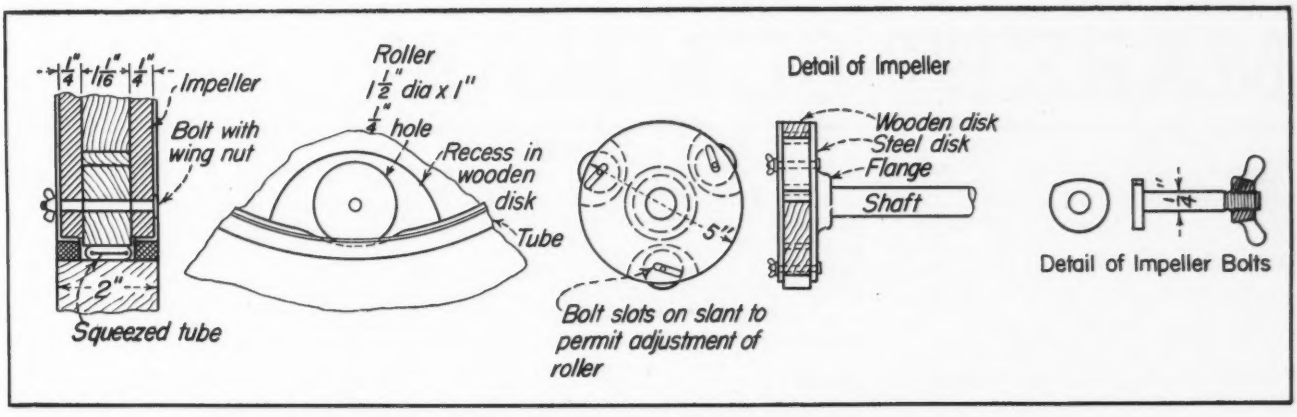
Small scale leaching tests on old mill tailings have been made successfully at the research laboratory of Kennecott Copper Corporation, Nevada Mines Division, McGill, Nev., with this apparatus devised by W. E. Sands, metallurgist. As illustrated, the equipment consists of a leaching vessel, a pump for recirculating liquid drained from the crock, and a glass bottle connected with the discharge line to prevent drainage of the solution if the pump fails. Solution pumped into beaker on top of the crock runs down the V-shaped glass rods which radiate about the rim of the beaker, and is thereby evenly distributed.

The ingenious pump employed consists of a wooden U-shaped block, a support with two bearings mounted on the base block, a shaft with impeller mounted on one end and drive pulley on the other. Three steel rollers bolted to the impeller assembly rotate in semi-circular recesses cut out of the wooden center disk. Slanting slots cut into the steel impeller disks permit adjustment of the position of these rollers.

The U-slot in the wooden pump base is grooved to receive rubber tubing with 5/16-in. inside diameter. A short length of glass tubing is contained in the suction section of the rubber tubing, where it is attached to an upright by a clamp to prevent deformation of the tube by the clamp.

When in operation the steel rollers of the revolving impeller alternately squeeze and release the rubber tubing in the U-slot, thereby producing suction and pressure required to operate the leaching circuit. Faces of the rollers and rubber tube section in the pump are lubricated with glycerine containing a small amount of graphite.

Because of construction of the pump, tube breakage may occur in the U-shaped block where pressure is applied. To prevent siphoning of the leaching solution from the crock in event of such breakage of tubing, the inverted glass bottle is placed in the suction line as shown. The quantity of leaching solution in-



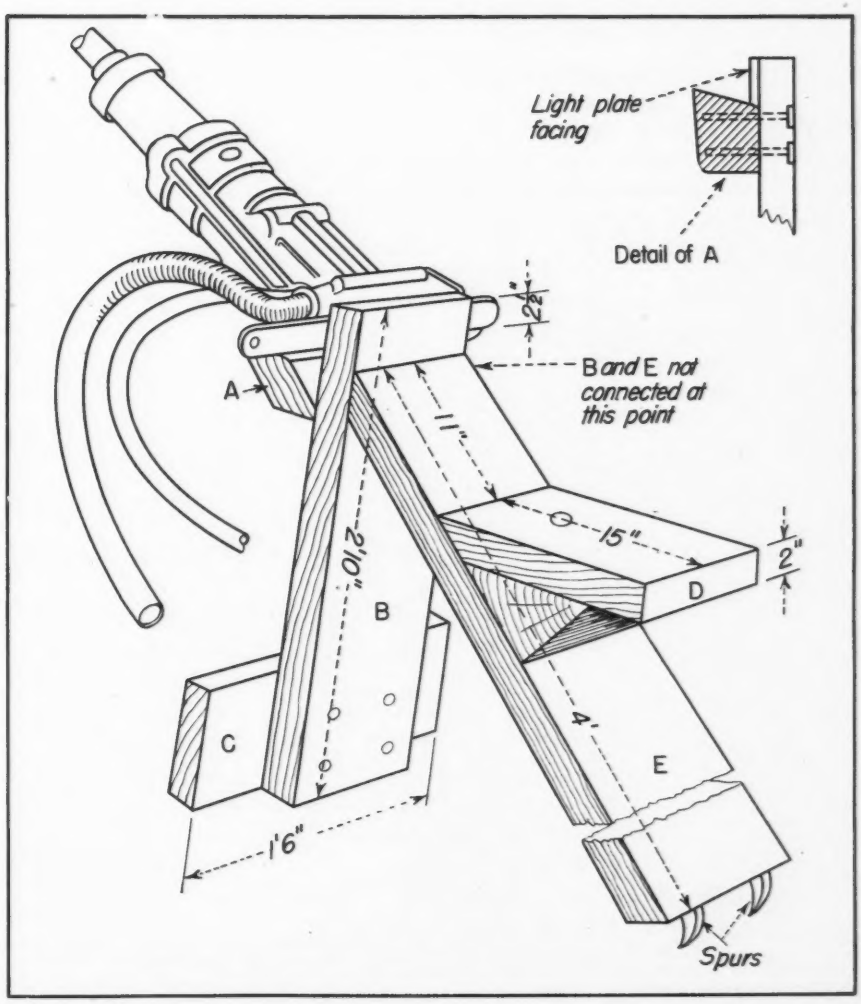
volved is never sufficient if breakage occurs to produce a static head in the crock, which would force the leach up into the inverted bottle and out through tube "X." Thus, if breakage occurred, only the small amount of solution in the line between the inverted bottle and the pump would be drained.

Rocking Horse Speeds Blockholing

The primary purpose of the rocking horse evolved by H. J. Leonard, former grizzly chamber foreman at Sherritt Gordon Mines, Sherridon, Manitoba, Canada, and illustrated herewith, is to facilitate the use of a jackhammer or sinker drill in the manner of a drifter in grizzly chambers. Prior to its development, all blockholing in the grizzly chambers was done with sinkers or stopers. However, where space restrictions ruled out the use of a stoper, horizontal and up holes had to be drilled with sinkers, requiring two men to do the job.

Efforts to reduce manual work involved, and to provide safety, led to the development of the rocking horse shown. It consists of a brace fitted with a seat for the operator and two pointed strap-iron spurs at the bottom to hold the horse in the desired place, and an upright containing the drill rest and foot rest. All parts making up the horse are made from 2x8-in. timber. The short section of the upright above the drill rest is fitted with a piece of light plate to obviate wear.

Bertram H. Wilson, Michipicoten Iron Mines, Ltd., Ontario, who submits this information, describes the following operating procedure: The miner seats himself on the saddle, thus counterbalancing the thrust from the weight of the plugger. After the hole is collared by careful use of the throttle, air and water are turned on full to drill the hole. The miner's weight causes brace to move slowly down the face of the body, pushing it ahead and applying pressure on the drill. When the brace has moved down through its full arc, drilling is stopped, and the device is re-set, either by using a longer drill shank or by moving the rocking horse ahead. Drill shanks varying from 2 to 20 ft. have been used successfully with the rocking horse device.



If a steel breaks, this equipment will not permit the operator to fall forward and injure himself as in the case of a plugger which is handheld in the usual manner.

MARKET SUMMARY

THE VOLUME OF BUSINESS booked by producers during November was highly satisfactory. Nervousness existed everywhere because of labor disputes in key industries, yet producers received few requests for postponement of deliveries because of strikes. The Surplus Property Administration announced on Nov. 19 that critical and strategic materials needed by the Army and Navy for defense purposes will be transferred to the stockpile, although civilian deficiencies in minerals and metals will be taken care of before any such transfer is made. The Military Affairs Committee has cleared proposed stockpile legislation that is to take the place of the measure now in force. The bill that is expected to come before Congress shortly is viewed by market men as a fairly realistic document.

Negotiations for extending the Government's buying program in copper originating outside of the United States were not completed as the month ended, but there was no reason to believe that purchases would not be continued. Consumption of copper in this country remains high, deliveries in October totaling 104,104 tons. In addition, 110 tons were exported. Production of refined copper in the United States amounted to 70,363 tons. The deficit, as for some months past, was made up of foreign copper released by the Copper Division. Figures compiled by the Bureau of Mines show that mine output of copper in the United States in the first nine months of 1945 amounted to 590,813 tons, against 756,597 tons in the same period last year. Severe manpower shortages caused the drop in output. The price situation domestically was unchanged. More talk is heard about a higher market after premium payments are abolished. Some irregularity in export quotations was noted on South American business.

Production of refined lead in the United States in the last quarter of 1945 is expected to make some gains. Furnaces that were down in the summer months have come into production. Some districts have experienced moderate improvement in the labor supply. Domestic consumption of lead has increased, and may average close to 70,000 tons a month in the October-December period. With domestic producers shipping around 44,000 tons of lead a month, foreign metal will be required on a substantial scale to meet current needs. Competition for foreign lead is increasing and there is growing apprehension over the ability of this country to obtain metal abroad next year in quantity without an upward revision in prices.

Deliveries of slab zinc increased

Major Metals

U.S. DAILY AND AVERAGE PRICES

1945 Nov.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
12	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR MONTH					
Nov.	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR WEEK					
Nov.						
7	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
	CALENDAR WEEK AVERAGES					
Nov.						
3	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1945 Nov.	Sterling Exchange: "Checks"	Silver (c): New York	Silver (c): London	Gold: London	Gold (d): United States
1	402.750	70.750	44d.	172s. 3d.	$35.000
2	402.750	70.750	44d.	172s. 3d.	35.000
3	402.750	(e)	(e)	(e)	35.000
5	402.750	70.750	44d.	172s. 3d.	35.000
6	Holiday	Holiday	44d.	172s. 3d.	Holiday
7	402.750	70.750	44d.	172s. 3d.	35.000
8	402.750	70.750	44d.	172s. 3d.	35.000
9	402.750	70.750	44d.	172s. 3d.	35.000
10	402.750	(e)	(e)	(e)	35.000
12	Holiday	Holiday	44d.	172s. 3d.	Holiday
13	402.750	70.750	44d.	172s. 3d.	35.000
14	402.750	70.750	44d.	172s. 3d.	35.000
15	403.000	70.750	44d.	172s. 3d.	35.000
16	403.000	70.750	44d.	172s. 3d.	35.000
17	403.000	(e)	(e)	(e)	35.000
19	403.000	70.750	44d.	172s. 3d.	35.000
20	403.000	70.750	44d.	172s. 3d.	35.000
21	403.000	70.750	44d.	172s. 3d.	35.000
22	Holiday	Holiday	44d.	172s. 3d.	Holiday
23	403.000	70.750	44d.	172s. 3d.	35.000
24	403.000	(e)	(e)	(e)	35.000
26	403.000	70.750	44d.	172s. 3d.	35.000
27	403.000	70.750	44d.	172s. 3d.	35.000
28	403.000	70.750	44d.	172s. 3d.	35.000
29	403.000	70.750	44d.	172s. 3d.	35.000
30	403.000	70.750	44d.	172s. 3d.	35.000
	AVERAGES FOR MONTH				
Nov.	402.891	70.750	44d.	—	35.000
	AVERAGES FOR WEEK				
Nov.					
7	402.750	70.750	—	—	
14	402.750	70.750	—	—	
21	403.000	70.750	—	—	
28	403.000	70.750	—	—	

Calendar week averages: New York Silver, Nov. 3rd, 70.750; 10th, 70.750; 17th, 70.750; 24th, 70.750.

(e) *Not quoted* (Saturday).

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotation on newly-mined domestic silver 999 fine was 70⅝c throughout November.

London silver in pence per troy ounce.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

from 41,881 tons in September to 53,225 tons in October. Demand for Prime Western and Special High Grade (galvanizing and die casting) improved in November, and deliveries for the month are expected to more than hold the gain established in the preceding month. Production of slab zinc in October was 65,514 tons, and is expected to show a moderate drop for November. Stocks reported by the Zinc Institute on Oct. 31 amounted to 245,664 tons.

The price of quicksilver showed further improvement, settling at $108 per flask. Demand was slow, but there was no selling pressure from either domestic or foreign sources. Production in September was estimated at 2,050 flasks, and consumption totaled 3,100 flasks.

The New York Official price of foreign silver held at 70¾c. all month. Canada is expected to revise its ceiling for silver to bring it into line with the world price.

Washington advices state that our Government has been considering a plan for purchasing tin in the Netherlands East Indies over an extended period of years.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for October and November:

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

	Oct.	Nov.
Quicksilver, N. Y. flask	101.385	106.870
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b)	16.500	16.500
Platinum, oz. troy	35.000	35.000
Cadmium (c)	90.000	90.000
Cadmium (d)	92.500	92.500
Cadmium (e)	95.000	95.000
Aluminum ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1937	90.86
1930	82.87	1938	73.67
1931	60.20	1939	77.71
1932	48.26	1940	79.22
1933	59.79	1941	83.49
1934	69.59	1942	86.80
1935	74.66	1943	88.74
1936	73.45	1944	88.74

	1943	1944	1945
January	88.74	88.74	88.74
February	88.74	88.74	88.74
March	88.74	88.74	88.74
April	88.74	88.74	88.74
May	88.74	88.74	88.74
June	88.74	88.74	88.74
July	88.74	88.74	88.74
August	88.74	88.74	88.74
September	88.74	88.74	91.16
October	88.74	88.74	96.40
November	88.74	88.74	96.42
December	88.74	88.74	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(Dec. 1, 1945)

Aluminum, ingot, 99 plus per cent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more	15.839c.
Bismuth, ton lots, lb.	$1.25
Cadmium, commercial sticks, lb.	90c.
Calcium, lb., ton lots, 97 @ 98 percent, cast	$1.85
Chromium, 97 per cent grade, lb.	89c.
Cobalt, 97 to 99 per cent, per lb.	$1.50
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation) troy oz.	$35.00
Quicksilver, flask of 76 lb., 25 flasks or more	$108.00
Selenium, 99.5 per cent, lb.	$1.75
Silicon, minimum 97 per cent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50 nom.
Titanium, 96 to 98 per cent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$9.00@$10.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.01
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 per cent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 60 per cent, duty paid	$24.00
Domestic, 60 per cent and upward	$24.00
Vanadium Ore, per lb. of contained V_2O_5 f. o. b. mines	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28
(a) Prices at mines, small lots, normally several dollars less.	

METALLIC COMPOUNDS

Arsenic Oxide (arsenic) lb.	4c.
Cobalt Oxide, 70 @ 71 per cent, lb.	$1.84
Copper Sulphate, 100 lb.	$5.00

ALLOYS

Beryllium Copper, 2,5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent per lb. of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum, 55 @ 65 per cent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 per cent, per lb. of contained Si	6.60@8.10c.
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 per cent C, gross ton	$133.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$8.50@$9.00
Missouri, 93 to 94 per cent $BaSO_4$, per short ton	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 per cent, all rail movement, ton	$30.00
Acid 98 and 1 per cent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica — Colonial Mica Corp., agent for Metals Reserve Co., quoted full-trimmed ruby muscovite domestic, April 1 to Sept. 30, inclusive — No. 1, $1.70 to $36.65 per lb., depending on size; No. 2, $1.25 to $26.00; No. 2 Inferior, 50c. to $16.00; No. 3, 25c. to $6.25. Prices f.o.b. nearest producer's rifting plant. Current quotations nominal.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$25.25
Steel, base price, Pittsburgh Billets, gross ton	$36.00
Structural shapes, 100 lb.	$2.10

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Stockpile Bill Rewritten by Senate Subcommittee

Two weeks after the hurried hearings on the Administration stockpile bill, S. 1481, the surplus property subcommittee of the Senate Committee on Military Affairs had prepared a new measure which seemed at that time to be headed for certain enactment. The committee was working under forced draft to write an acceptable measure that could be passed by Jan. 3, 1946, the deadline after which Government stocks of metals and minerals accumulated under Section 22 of the Surplus Property Act would be sold. It developed what most Washington observers believe is a sensible compromise on the stockpiling issue.

In its general form, the subcommittee amendment closely follows the Thomas bill, starting with an identical declaration of policy. The stated objective is to stockpile materials so that the United States will be less dependent upon foreign sources and to encourage domestic conservation and production of critical and strategic materials.

The bill then provides for the establishment of a stockpile board with a chairman appointed by the President with the "advice and consent of the Senate." Board members are specified to be the secretaries of State, Treasury, War, Navy, Interior, Agriculture, and Commerce. The President also is given the power to designate the agency within which the Board is to be established. The Office of War Mobilization and Reconversion is thought to be the agency to which the new board will be assigned if the bill is passed. Power to act is vested in the chairman, board members serving in an advisory capacity, a set-up like that of the War Production Board. Also assisting the chairman are industry advisory committees appointed by the chairman. This is a new idea.

In both the Johnson bill and the subcommittee amendment, the President, with the advice of the Board, is to determine which materials are strategic and the qualities and quantities to be purchased. Provision is made for the President to delegate this power. The Thomas bill in its original form differed in that the materials and the quantities were to be as reported by the Army-Navy Munitions Board to Congress on Jan. 2, 1945. The Munitions Board report would have served as a point of departure for future stockpile determinations.

All three bills are alike in directing that the materials for stockpiling be acquired from supplies in excess of current industrial demands. The subcommittee version carries the additional provision that purchases cannot be made at prices above the current open-market prices—i.e., no subsidies.

The "Buy American" provisions of the subcommittee amendment are somewhat stronger than in the original Thomas bill. The Johnson bill contained no provision for the purchase of domestic materials. Storage is to be on military or naval reservations. Necessary refining or processing to convert materials into the best form for stockpiling is permitted, and may be done either before or after transfer to the stockpile from another Government agency.

The committee amendment tightens the freezing provisions. Disposition may not be made until six months after publication of a notice in the Federal Register and similar notice to Congress. In the notice there must be stated the reason for the revised determination which makes the disposal necessary, the amounts of material to be released, the plan of disposition, and the date upon which the material is to be made available for sale. The plan and the time of disposition must be chosen to protect the Government from loss and also to protect industry against a disruption of the market. Specific approval of Congress must be obtained of disposal for reasons other than obsolescence.

A provision is included for reports to Congress at six-month intervals which must give among other things a statement of foreign and domestic purchases. Quarterly reports must be made to the Army-Navy Munitions Board on the current status of the stockpile.

Functions to be performed by the Bureau of Mines and the Geological Survey as they are staked out in the subcommittee amendment seem to be somewhat broader than the organic acts setting up those agencies. This means nothing unless Congress appropriates the necessary funds. The Bureau and Survey are "authorized and directed" to investigate the availability and treatment of ores and to develop domestic sources of supply, to devise new methods for handling low-grade reserves, and to find substitutes.

Section 9 of the subcommittee amendment provides that money received from the sale of stockpile materials shall go back to the U. S. Treasury, making the fund liquidating rather than revolving. This provision does not apply if the sales are made to rotate stocks. In Section 10 permission is given the board to import foreign materials duty free. If these imported materials are sold later in the domestic market the price must be at least the cost to the Government plus the amount of the duty in effect at the time the sale was made, if sale is made at other than the domestic market price.

A quick survey of Washington officials made just before this issue of *Engineering and Mining Journal* went to press indicated that all factions could be expected to support the subcommittee version of S.752.

Gold-Mine Relief Is Stalled in Committee

More than ever some means is needed to relieve gold mine operators from financial difficulties caused by the late but not lamented L-208. According to mining industry members in Washington, S-27, which provided for a moratorium for the operators of gold and silver mines closed by L-208, would accomplish this objective if it could be enacted. The bill is still gathering dust in the House Committee on Mines and Mining.

On Nov. 13, 1945, inquiry at the chairman's office disclosed that the Committee on Mines and Mining has not met since Mr. Somers, of New York, took over the chairmanship on Jan. 10, 1945, and thus no action has been taken of any legislation before it. In the case of S.27, a subcommittee has already done its work, and it is understood that Mr. Somers intends to call the full committee sometime in December for final consideratoin of the bill, probably too late for Congressional action this year.

The subcommittee substituted most of the language of H.R. 1780, which applies to operators of all kinds of mines, for that of S.27, which is restricted to operators of gold and silver mines.

Most gold mine operations employ installment contracts, chattel mortgages, bonds, or leases. When the gold mine closing order was in effect, the operator had a valid reason for not complying with the terms of his agreement. Now he is faced with the obligations of two and one-half years in one lump, and it is too much to expect that no attempt will be made by lenders to pick up valuable properties that may be in distress.

S.27 permits the operator to go into court for relief. The court may postpone the obligations for a period found to be necessary for the mine operator to get on his financial feet, but in no case to exceed twelve months

after the termination of the war.

It is understood that Senator McCarran, author of S.27, has no objection to the language of the bill as it was rewritten in the subcommittee. This simplifies the matter of final passage providing Congressman Somers calls his committee together.

Tin Supply Will Be Short for Several Months

The story that the Japs left 17,000 tons of tin on the dock in Malaya has not been substantiated by later information. Only about one-tenth of that amount is now known to exist. Rumors that both the Malayan smelters were in operation at the time the British went into Malaya have proved false. The Singapore smelter is out of commission. It will be some time before this plant can be returned to operating condition. On the other hand, the Penang smelter was found to be undamaged and presumably is being put into operation as soon as fuel, raw materials, and labor can be assembled. This will take time.

One of the big problems is the difficulty of recruiting top administrative and technical personnel for operation of the smelters. Many of the key men have been prisoners of the Japs and are returning to their homes in Europe to recuperate from the hardships they underwent.

So far the British have sent an ore-buying mission into the area, which, according to the latest reliable reports, has only recently arrived in Malaya. This group is now appraising the condition of facilities. Up to mid-November there had been no report of any difficulty with the native population in British Malaya.

The political situation in Java is tense. The native uprising has slowed the influx of officials. As long as the Dutch Government remains at Brisbane the outside world will know that the trouble between her Majesty's Government and the Javanese still persists.

In spite of this, it has been learned on good authority, that a small group of engineers of the Billiton Tin Co. arrived on Billiton Island. They are reported to have met with no trouble from the native population.

In making any estimate of when tin will again be produced, officials explain that it will take some time for the damage to be assessed. Additional time will be required for repair equipment to reach the scene and to be installed in both Malaya and the Netherlands East Indies. The more mechanized operations will be delayed until adequate equipment and repairs are available. The lack of parts will make early operation impossible.

In the meantime, it is believed that a small production will originate in the Chinese-owned mines in Malaya and perhaps from a few of the deposits of the Netherlands East Indies.

Certain tonnages of concentrates have been found in Burma, Malaya and Siam, but it is not believed that these will be moved to treatment works until the ownership has been worked out.

American engineers are now on their way to observe and report on the progress being made in the rehabilitation of the tin properties of the Far East. It is not believed, however, that an intelligent appraisal of the situation will be available before spring.

No better indication of the attitude of official Washington regarding tin supplies can be found than the continuation of the campaign to collect cans for detinning. As late as Nov. 16, J. D. Small, Administrator of the Civilian Production Administration, stated that recoveries of the detinning plants must be stepped up because there was no certainty that tin supplies from the Far East would reach this country in the near future.

Action Is Expected to Preserve War Records

Companion bills were introduced in the Senate and the House by Senator Hayden and Congressman Murdock "to insure the preservation of the technical and economic records of domestic sources of ores of metals and minerals." This is the same legislation that failed to pass in the Senate on the last day of the second session of the 78th Congress. Washington observers expect the bill to be enacted in the present session, but not without hearing the same arguments pro and con.

The legislation proposes to make the Bureau of Mines the repository of records of the mineral industry which have been gathered by various Government agencies during the war. Under the terms of the bill any of the war agencies would notify the Bureau of Mines when their files were no longer needed. The records would be examined by the Bureau with the aid of members of the agency's staff, and after elimination of duplicate and extraneous material, the remainder would be put "in such form as will be of greatest permanent value to the national economy."

The bill does not provide for a final examination and report on the condition of mining properties that are closed down after the war. No money is available, and the chances of an appropriation for this work are nil.

There has been some concern regarding the possibility that confidential material that might be in the Government files would find its way into the hands of the public if the material were placed in the Bureau of Mines. The organic law under which the Bureau was established prohibits the publication of such confidential information. Nothing of commercial use or that may determine the value of a property may be made public. There is, however, a very simple method by which the material can be secured by any interested party. It is necessary only to get a release from the owner of the property. This will permit the Bureau of Mines to make public the information on the particular property.

Official View Toward Metal Prices Is Bullish

The question of what would happen to the prices of copper, lead, and zinc if ceiling prices were removed has been a subject of much Washington speculation. The opinion of most Government officials falls into a definite pattern.

The general feeling regarding the price of copper is that it will find its level somewhere between 14c and 15c a pound. The most popular figure is 14¼c, a rise of 1¾c above the present ceiling.

There is no such hairsplitting in the opinions regarding the probable movement of lead prices in a free market. Agreement could be found on only one point—that the price would rise. Most of the metal men questioned believed that the price of lead would become stable somewhat above the price of zinc.

The price of zinc is expected by most officials to sag slightly if price ceilings should be removed. They believe that the ceilings on zinc have actually tended to hold the price up in a sensitive market rather than to hold the price down. There are some, however, who believe the price would remain firm at the present ceilings and might even advance somewhat, presuming that the Premium-Quota plan is slated for abandonment.

New Bills Would Restore Free Circulation of Gold

Companion bills were introduced in mid-November into Senate and House to re-establish free circulation of gold. S.-1596 was introduced by Senators Murray and Taylor and H.R.-4669 by Congressman Engle.

These proposals provide for free circulation and convertibility of gold, for coinage of a $50 gold piece, and for the President to have authority to raise the Government price of gold above the present figure of $35 per ounce.

The immediate reaction in Administration circles was unfavorable, on the grounds that there is not enough gold in Government stock to satisfy all conceivable demands. Inasmuch as no modern paper currency is backed 100 percent by monetary metals, this viewpoint denotes either acceptance of the idea of 100 percent backing or a disturbing fear in the minds of officials that the public lacks confidence in the nation's currency.

NEWS OF THE INDUSTRY

Soviet Starts Restoration of Petsamo Nickel Plants

Restoration has begun on installations in the Pechanga (Petsamo) nickel district of the Soviet Union, which until recently was a part of Finland, according to a Soviet mining journal. Power facilities are being rebuilt, personnel is being recruited, and housing restored.

The main plant was reported to have been completely destroyed during the German occupation. A 140-meter smokestack was blown up, and all industrial buildings, including the chemical laboratory and general offices, were wrecked. Only the boiler plant, containing two boilers; the bodies of two shafts; and some mining equipment and tools, were left intact.

Operations are reported to have begun in the Kaulatunturi mine. This mine is located in the largest of 13 sulphide-nickel deposits in the region. Reserves of ore, which contains also copper, cobalt and precious stones, are estimated at 1,000,000 tons.

Stockpile Figures Reported For Metals and Minerals

Strategic materials held in storage by the Office of Metals Reserve of the Reconstruction Finance Corporation as of Sept. 30, 1945, were reported as follows by the *Wall Street Journal*:

Aluminum: Primary, 385,140,335 lb.: secondary, 6,223,128 lb.
Antimony (stored in U.S.) 9,596 short tons; (stored in Chile) 4,437 short tons.
Arsenic (stored in U.S.) 3,173 short tons; (stored in Peru) 3,588 short tons.
Asbestos 18,678 short tons.
Bauxite ore (in U.S.) 2,686,060 long tons; (in Surinam) 108,113 metric tons.
Beryl ore 4,758 short tons.
Bismuth 840,589 lb.
Cadmium (pencils, balls and sticks) 1,338,914 lb.
Calcite (includes 520 lb. optical) 3,559 lb.
Celestite 9,278 short tons.
Chrome ores and concentrates (stored in U.S.) 861,879 long tons; (stored abroad) 66,439 long tons.
Cobalt 3,325,205 lb.
Columbite 33,991 lb.
Copper (U.S. and Canada) 508,726 short tons; (South America) 35,117 short tons.
Corundum 1,833 long tons.
Cryolite 25,512 long tons.
Industrial diamonds 490,436 carats, plus 3,512,439 carats of crushing bort, imperfectly crystallized diamonds.
Electro manganese 400,000 lb.
Ferromanganese 4,429 long tons.
Ferrovanadium 1,805,568 lb.
Fluorspar (metallurgical) 177,557 short tons.
Gold ores and concentrates (abroad) 35,925 short wet tons.
Graphite: Ceylon 729 long tons; Madagascar 2,292 metric tons; domestic 2,942 short tons.
Iridium 3,147 troy oz.
Kyanite 3,526 long tons.
Lead 82,335 short tons.
Magnesium, secondary, 2,215,566 lb.
Manganese ore (in U.S.) 964,477 long dry tons; (abroad) 230,190 long dry tons.
Mercury 63,638 flasks.
Mica (block) 6,890,354 lb.; (splittings) 4,502,166 lb.
Molybdenite 4,747,628 lb.
Nickel 34,644,021 lb.
Osmium 185 troy oz.
Palladium 71 troy oz.
Platinum 31,148 troy oz.
Quartz crystals (includes 3,478,498 rejects) 4,819,848 lb.
Rhodium 161 troy oz.
Ruthenium 39 troy oz.
Rutile ore 3,091 short tons.
Silver 7,413,094 troy oz.
Spodumene 1,631 short tons.
Talc (domestic ground) 6,576 short tons.
Tantalum-columbium slags 340 short tons.
Tantalite 427,898 lb.
Tin 53,551 long tons.
Tungsten 22,181,997 lb.
Vanadium 1,805,568 lb.
Zinc (in U.S.) 571,167 short tons; (ores stored abroad) 165,460 short tons.
Zircon 2,581 short tons.
Zirconium ore 15,848 short tons.

Quantities listed represent metal content or equivalent, unless otherwise specified, though the actual stockpiles may be in form of ore or concentrate. Materials are stored in the United States unless otherwise specified.

Louis Shattuck Cates Is New Head of A.I.M.E.

Louis Shattuck Cates, president of Phelps Dodge Corporation, was elected president of the A.I.M.E. for 1946, according to an announcement made at a recent board of directors' meeting at Institute headquarters in New York. Vice presidents and directors elected are as follows: Holcombe J. Brown, consulting engineer of West Newton, Mass.; and Erle V. Daveler, vice president of the American Zinc, Lead & Smelting Co. Directors elected are: W. E. Brewster, general superintendent of Wisconsin Steel Works; Dr. August B. Kinzel, vice president of Union Carbide & Carbon Research Laboratories, Inc., and vice president of the Electro-Metallurgical Co.; Philip Kraft, mining engineer of Newmont Mining Co.; David D. Moffat, president of Utah Copper Co.; Russell B. Paul, mining engineer of the New Jersey Zinc Co.; and William B. Plank, head of the mining department, Lafayette College, Easton, Pa.

Mr. Cates received the William Lawrence Saunders Gold Medal from the A.I.M.E. in 1939 in recognition of his outstanding achievements as an engineer in the development of large-scale methods of mining copper ores, and as an administrator of important mining and metallurgical enterprises.

Mexican Mine Workers Post Strike Notice

Mine and smelter workers in Mexico have posted a strike notice that threatens to shut down most properties recovering silver unless an increase of 40 percent in pay is granted before Dec. 17. The National Miners Union, controlling 35,000 workers, issued notices to 30 companies operating in Chihuahua, Hidalgo, Guanajuato, Zacatecas, Durango, San Luis Potosi, Guerrero, Oaxaca, Nuevo, Leon, and Coahuila, as well as to five refineries.

O.P.A. Objects to Higher Steel Price

Chester Bowles, Price Administrator, announced on Nov. 23 that OPA finds no cause at this time for a general increase in steel prices. However, he declared that OPA will watch the trend in current costs and earnings in the steel industry, and the pricing agency intends to review the subject as soon as financial returns are submitted by steel companies after Jan. 1.

OPA has been deeply concerned, Mr. Bowles said, over the fact that many small non-integral steel companies are in financial hardship. These small companies, he said, may apply for price relief at any time. If they can show losses on their operations, price adjustments would be made the same as in other industries.

The United States Steel Corporation holds that it could not negotiate with the United Steel Workers, CIO, for a wage increase without a general upward revision in steel prices.

Olin Turns Down Offer to Purchase Aluminum Plant

John M. Olin, president of Olin Industries, Inc., announced recently that his company cannot at this time purchase or lease the Tacoma aluminum plant, which it operated for the Government during the war. Present and unpredictable future economic conditions were attributed by Mr. Olin to be among the principal reasons why his company did not accept the offer of the Office of Defense Plants to acquire the plant.

"The future of the commercial aluminum industry is too uncertain at this time to justify us to assume the enormous risks involved," Mr. Olin said. "Statistics now at hand show a large amount of both primary and secondary aluminum in inventory, as well as present manufacturing facilities far beyond estimated postwar requirements for production of the metal. In the face of these two facts alone, it would be virtually impossible for a new commercial producer to promptly develop the necessary market for his products.

"Moreover, it is our opinion that only a company which is fully inte-

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grated could enter the aluminum industry as a permanent venture. The present operating procedure of the industry demands that any company entering the industry should have ore deposits available of the proper quantity, quality, and cost, together with facilities for the production of its own alumina, reduction facilities for the production of metal, and facilities for fabrication."

However, in view of the many plans being considered for the future development of the aluminum industry, Mr. Olin said, it was the intention of his company to re-evaluate the aluminum situation from time to time. Recommendations are being made to the government, Mr. Olin added, that the Tacoma plant be closed and maintained in a stand-by condition.

The Tacoma plant has an annual capacity of approximately 40,000,000 lb.

NEWS BRIEFS

A.I.M.E. to Meet. The Annual Meeting of the American Institute of Mining and Metallurgical Engineers will be held in Chicago, Ill., Feb. 25 through 28.

Uranium in Brazil. The Brazilian Academy of Sciences has recently announced that mineralogists have uncovered proof of the existence of uranium deposits in the states of Minas Gerais and Paraiba. The Academy has requested the Brazilian Government to allocate funds for intensified research to determine in what quantities uranium is present.

Alaska Juneau Repair Work. Nearly a million dollars will be required for repair work to put the Alaska Juneau mine back into full-scale production, according to C. A. Norris, president of the company, and P. R. Bradley, Jr., engineer. Mr. Norris also stated that there must be an adjustment between wages and the price of gold.

Overland Travel to Alaska. Alaskans can now reach the States by bus and rail transportation. O'Hara bus lines carry passengers from Fairbanks to Whitehorse,, and British Yukon Navigation Co. buses run from Whitehorse to a railroad town on Dawson Creek.

Saskatchewan Mineral Tax. Federal judicial officers at Ottawa have upheld the Saskatchewan Mineral Taxation Act of 1944, which was contested by the Canadian Pacific Railway Co. The Act provides that owners of mineral lands which are not being developed and which are being held for either speculative or other non-social purposes must pay a tax of 3c. per acre. Canadian Pacific, which holds nearly 10,000,000 acres of free land with mineral rights including grants by the Government, opposed the Act on the ground that it was unconstitutional.

Bombing, Fire, Looting, and Decay Contribute To Damage Suffered by Philippine Properties

Some Were Completely Destroyed—One Was Maintained by Japs Who Intended to Operate It After the War—Machinery Replacements Will Restore Few to Operating Condition

SPECIAL CORRESPONDENCE

Acoje Mining Co. Before the war, this company employed more than 1,000 men and produced daily 500 tons of shipping grade chromite containing an average of 48 percent Cr_2O_3 and having a ratio of 2.2:1.

During the period of occupation, the Japanese operated the mines, but no exact figure of the tonnage mined by them is available. The company has originally had 50,000 tons of ore in the wharf and 10,000 in the mine, all of which had been shipped by the Japs in addition to quantities mined by them.

The open pits, from which most of the chromite was mined, are now caved in or re-covered with overburden, and partly filled with water during rainy seasons. Underground workings used to mine one or two lenses and are still open, but need repair badly. All wooden chutes and grates need replacement.

Both the mill building and equipment, which were 80 percent completed before the war, remain intact. Mill accessories are still in their original boxes. When completed, the mill will treat 1,000 tons of ore a day.

When the Japs abandoned the property, they burned the mine office, warehouse, hospital, machine shop, power house, assay office, sawmill, and some bunkhouses. The guest and manager's house were shelled. Several buildings were left, but were looted by the people. These buildings are now being reconditioned by the company.

The loading wharf needs repairs, and the road from the mine to the wharf must be cleared of brush. A long bridge over the divide near the mine will have to be replaced. Roads leading to all mine workings are in good condition.

Before operations can be resumed transportation facilities and stores of food must be supplied. In order to mine and transport 250 tons of ore per day to the wharf, the company needs 25 dump trucks, a sawmill with 20,000 b. f. capacity per 24 hr., about 25,000 pesos' worth of hand tools, and two bulldozers.

Consolidated Mines, Inc., operated by Benguet Consolidated Mining Co., owns low-grade chromite claims 27½ km. east af Masinloc. The chromite is suitable for refractory purposes only. Before the war Benguet Consolidated operated the property on a profit-sharing basis, and it was said that by the end of 1941 Benguet was about to recover its investment, and share profits on a 50-50 basis.

During the occupation, the Japs did not operate the property. Instead, all machinery and supplies were removed, and stripping of accessories was so complete that even the bolts of bridge trusses were removed, rendering the bridges unfit for use by heavy trucks.

Benches of the open pit are badly damaged by slides, caves and water. Roads leading to the benches and pits are caved in or washed out. No mining equipment remains with which to start operations.

The 28-km. company-owned road from mine to wharf is badly covered with overgrowth, but is built on good solid ground. A big slide has occurred at Km. 11¼, and a small bridge was burned at Km. 14. Both were repaired sufficiently to allow light cars to pass. Most of the bridges have been neglected during the past three years and will require replacement. A portion of the loading pier which was blasted by guerrillas also needs repair.

Prior to the war, ore was mined by contract at the rate of 0.90 peso per ton for labor. Transportation cost to the pier was 2.40 pesos per ton, and loading cost was 0.50 peso per ton.

According to advices just received, the status of producing mines in the Baguio district in September was as follows:

Balatoc Mining Co. Americans bombed the camp, and only three staff houses remain. The mill and bunkhouses were burned completely, and all equipment and supplies were burned or looted. Nothing could be salvaged of the machinery in use. Mine openings were burned and caved in. 1,500 level is open to the shaft, but it is gassy and warm. The main drainage tunnel, which the Japs used as a hospital and later burned, is cleared to 800 ft. The tunnel from the mine office was also burned and caved in, but is cleaned to 50 ft. Fifty men are employed in cleaning the mine and camp. Prewar capacity of the mill was 2,250 tons per day, and the power plant was rated at 7,500 hp.

Benguet Consolidated Mining Co. The mine plant, mill, and all buildings of this property were destroyed during the last moment before occupation about April 11, 1945. The power plant building was bombed, and can be used only temporarily. Five 625-hp. diesel engines were stripped of small parts, but can be restored to usefulness. Two large diesels were removed by the Japs, but large

(*Continued on page* 158)

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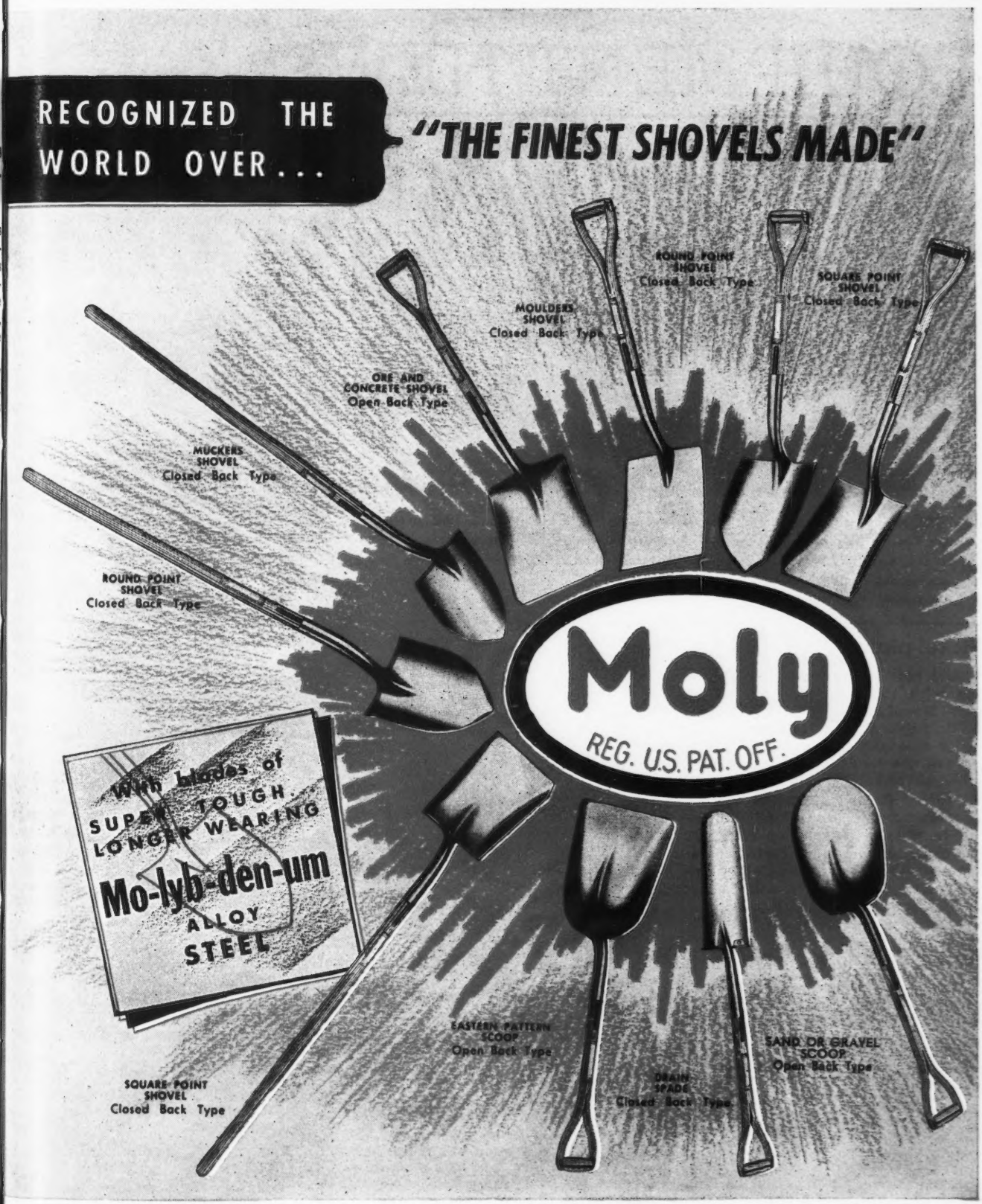
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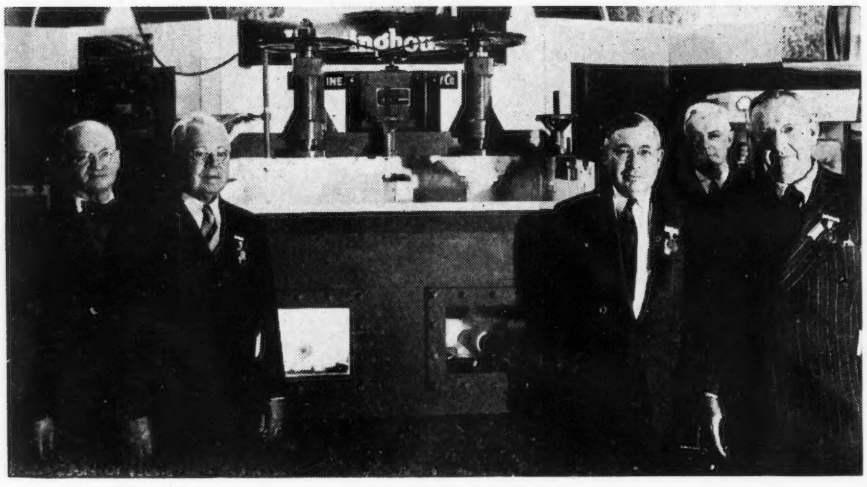
EQUIPMENT NEWS



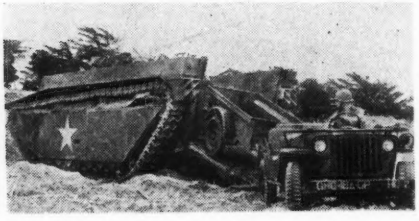
FEATURE of the equipment exhibit held in connection with International Mining Day at El Paso, Tex., in November was the new Massco-Fahrenwald flotation machine, on view for the first time. Shown above at the exhibit are (left to right): E. W. McQuade, Oscar Johnson, president, J. D. Nicholson, and R. S. Beard, all of Mine & Smelter Supply Co. R. A. Wagstaff, A.S.&R. metallurgical engineer, is behind Mr. Beard.

Nickel-plated Pipe

Steel pipe electro-plated on the inside with nickel is now offered by Bart Manufacturing Co., Belleville, N. Y. Application of the inner coating is a relatively inexpensive process, and the result is a smooth ductile pore-free nickel deposit fully adherent to the metal. It can be applied to tubing up to 18 in. in diameter and in random lengths up to 20 ft. The nickel coating adds corrosion resistance without affecting the low cost, strength, and fabricating characteristics of steel pipe. Fittings and accessories are available.

Water Buffalo for Sale

Amphibious tractors, called water buffaloes in the Army, will soon be available to peace-time models, ac-



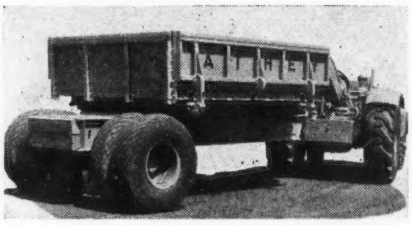
cording to Food Machinery Corporation Riverside, Calif. The craft can make 22 m.p.h. fully loaded on land, 5.5 m.p.h. on water. Cargo capacity will be about 6 tons, and loaded it can climb a 54 percent grade.

Low-Priced Welder

Meeting the requirements of rural utilities and REA, a new low-priced welding machine, called Fleet-Arc Jr., is now produced by Lincoln Electric Co., Cleveland, Ohio. It can be used with the standard 3-kva. power tranformer provided by power companies, and its current range is from 20 amp. at 20 volts to 180 amp. at 25 volts. It will handle electrodes ranging from 1/16 in. to 5/32 in.

Rubber-Tired Trailer

Designed for use with the Caterpillar DW10 tractor for high-speed hauling on mining and other earth



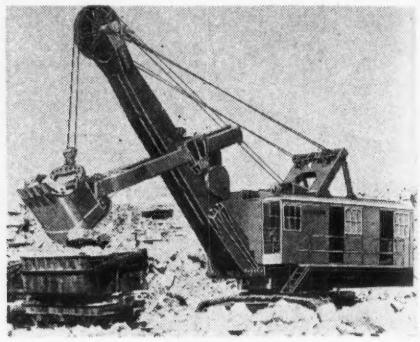
moving jobs, the new rubber-tired trailer unit recently announced by Athey Products Corporation, Chicago, Ill., has a maximum capacity of 15 tons. The load is dumped from either side.

Precision Tachometer

A new precision direct-indicating hand tachometer, said to be of prewar type and quality, has been announced by James G. Biddle Co., 1211 Arch St., Philadelphia 7, Pa. The new instrument has two scales and five ranges covering speeds between 45 and 18,000 r.p.m. It is supplied complete with carrying case and accessories, including a 6-in. circumference wheel for measuring surface speeds.

Heavy-Duty Shovel

The first postwar addition to its line is announced by Marion Steam Shovel Co., Marion, Ohio. It is the Type 151-M, said to be designed for heavy-duty work in quarry or mine. It carries a 6-cu.yd. dipper with standard front end or a 5-cu.yd. dip-



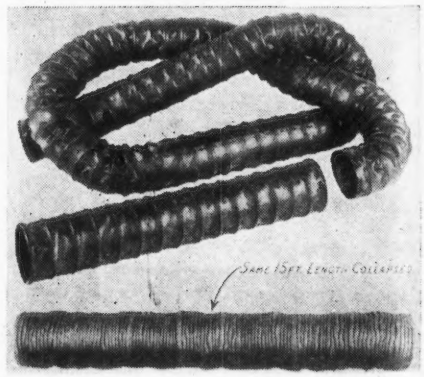
per with long range front end. The machine is converible to a dragline with bucket sizes ranging from 3½ to 7 cu.yd. and boom lengths from 80 to 120 ft. The latest type of high-speed electrical controls, Amplidyne and Rotorol, have been incorporated in the 151-M.

Quick-Change Brake Block

Raybestos-Manhattan, Inc., Passaic, N. J., announces a new type of brake block, called Key-Lok, which is attached by sliding into metal retaining strips on brake bands rather than by the conventional bolt-type methods. Eight important advantages are claimed by the manufacturer for the new brake block. Full details will be furnished on request.

Ventilating Hose

Metal-reinforced light-weight air ducts are now offered by American Ventilating Hose Co., New York, N. Y., under the trade name of Portovent.



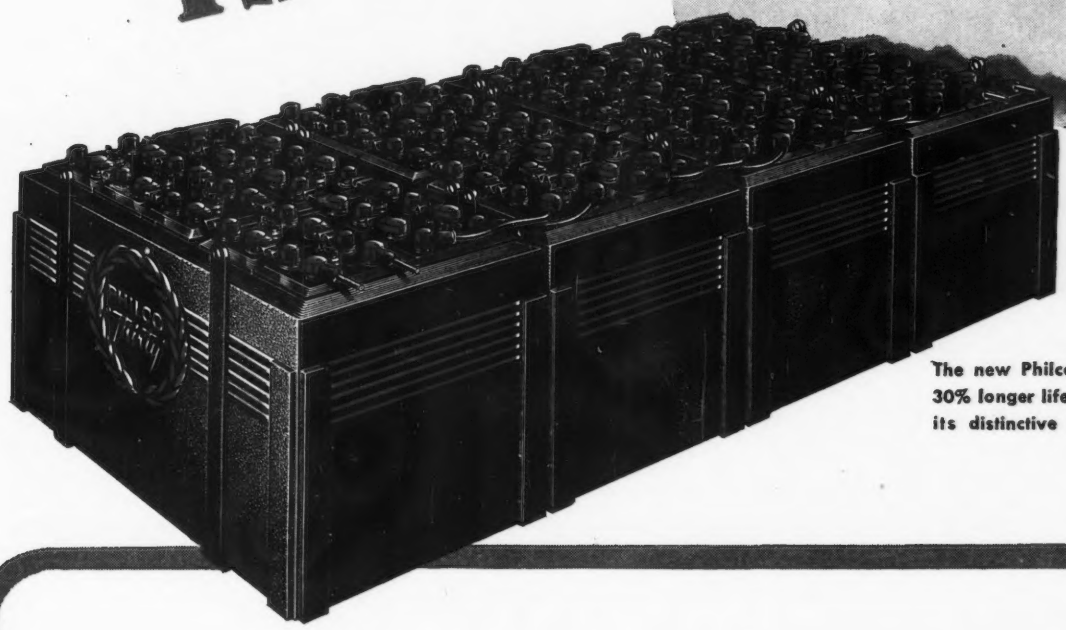
Any desired length from 2½ ft. can be coupled to form tight joints, and the metal reinforcing rings hold the duct open around sharp bends. Diam-

BATTERY POWER IS SAFE

"The Bureau does not have a record of an explosion or a mine fire caused by permissible storage-battery locomotives that have been maintained in permissible condition."

U. S. Bureau of Mines
Information Circular I. C. 7302
November, 1944

Quoted by Permission



The new Philco "Thirty", with 30% longer life, is identified by its distinctive red connectors.

Tune in The Radio Hall of Fame, with Paul Whiteman and His Orchestra, Sundays, 6 P. M., EST — ABC (Blue) Network (Coast-to-Coast).

★

FOR 50 YEARS A LEADER IN MINE STORAGE BATTERY DEVELOPMENT

Greater safety is one of the major reasons for installing battery-powered haulage equipment. Especially so, when you consider the low cost, ease of maintenance and long life of modern high-capacity Philco Mine Batteries. The new Philco "Thirty" with 30% longer life, has introduced a new era in low cost per ton hauled with battery-powered locomotives and shuttle cars. Write for the facts today.

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

PHILCO

Famous for Quality the World Over

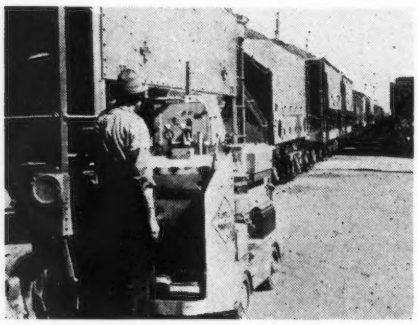
eters range from 5 to 24 in. Compression for packing is 6 to 1.

Decimal Point Spotted

A new type of slide rule that places the decimal point accurately in expressions up to 19 digits is now offered by Pickett & Eckel, 53 West Jackson Blvd., Chicago 4, Ill. Priced at $13.50, the rule is made of white plastic on a Dowmetal base, and is said to offer great accuracy in work involving square and cube roots and logarithms as well as ordinary arithmetical problems.

Power Truck Dumps Cars

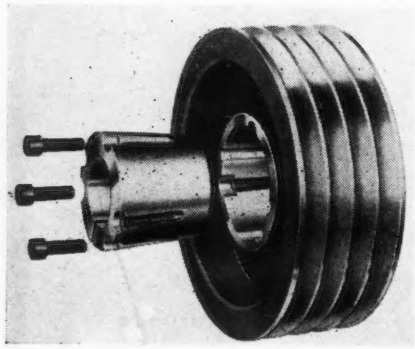
Developed by Elwell-Parker Electric Co., Cleveland, Ohio, the power truck shown herewith has been found



useful in dumping the cars of iron ore at Duluth and Two Harbors, Mich. The truck motor is geared to operate a wrench that opens the hopper bottoms of the cars. Two men, using a 4-ft. wrench, formerly did the job.

Quick-Mounting Sheave

To install the Taperlock V-belt sheave, recently announced by Dodge Manufacturing Corporation, Mishawaka, Ind., it is only necessary to slip the sheave and bushing assembly onto



the shaft and tighten two or three locking screws, depending on size of sheave. The screws are in threaded engagement with the sheave hub and free in the bushing groove. As the screws are tightened, they press against the tapered bushing, forcing it into the tapered bored hub. The bushing contracts and wedges between the hub and the shaft.

To remove the sheave, the locking screws are removed and inserted in jackscrew holes partly in the hub and partially in the bushing. Only the portion of the holes in the bushing is threaded. Tightening the screws dewedges the bushing and frees the sheave. The wedging action provided gives the equivalent of a shrunk-on fit on the shaft, whether it is standard or normally undersize.

Anti-Fog Preparation

A new anti-fog preparation for keeping goggles, face shields, and welding plates clear has been announced by American Optical Co., Southbridge, Mass. The new material deposits a thin film on the glass that helps prevent fogging, steaming, or frosting. It is applied by spreading on both surfaces of the lens, rubbing, then polishing.

Diesel Lubricator

Prepared as an additive to diesel fuel oil, a new Gibraltar fuel oil concentrate is now offered by Hood Refining Co., 169 N. Hamilton Ave., Greensburg, Pa. The preparation is said to prevent corroding and sticking of injector nozzles, and in addition gives top cylinder lubrication. The concentrate is also said to curtail carbon formation.

Silicone Varnish

A new Silicone varnish recently announced by Dow Corning Corporation, Midland, Mich., is reported to enable all types of electrical shops to make use of the advantages of Silicone insulation. The new varnish is cured at the low temperature of 300 deg. F., which does not affect shellac-bonded mica or core plating, and electrical equipment can be baked fully assembled. Electrical equipment wound with Silicone insulating materials and sealed by impregnating with the new varnish (Type DC-996) will have the high order of thermal stability and retention of waterproofness characteristic of Silicone insulation. These materials are available through leading distributors.

INDUSTRIAL NOTES

Wawland H. Evans, founder of Evans Associates, Inc., Chicago, Ill., advertising agency, died Sept. 29.

Cummins Engine Co. announces that its expanded sales department will be headed by **Norman E. Palmer,** general sales manager, assisted by **J. D. Allen,** manager of dealers sales **Fred W. Sparks,** manager of manufacturing accounts. **Paris E. Letsinger** continues as vice president in charge of distribution.

A syndicate headed by **Walter E. Schott,** Cincinnati, Ohio, has acquired the **Cleveland Pneumatic Tool Co.,** Cleveland, Ohio.

G. V. Woody has been appointed to succeed **R. C. Newhouse** as manager of the basic industries department of **Allis-Chalmers Mfg. Co.** Mr. Newhouse is retiring after 40 years of service.

Glenville A. Collins, consulting engineer, has reopened his office at 604 Porter Bldg., Portland 4, Ore.

Edwin A. Wert has been appointed general manager of the Southwest region for **Kennedy-Van Saun Mfg. & Eng. Corporation,** New York, N. Y.

Wood Shovel & Tool Co., Piqua, Ohio, announces the appointment of **V. G. Scott** as manager of sales.

Edwin M. Perrin, advertising manager of **Robins Conveyors** since 1942, has been promoted to assistant manager of equipment sales.

Weston G. Frome has been appointed general manager of the explosives department of **Atlas Powder Co.,** succeeding **F. S. Pollick,** who has been elected to the executive committee.

Canadian Longyear, Ltd., North Bay, Ont., announces plans for the erection of a new manufacturing plant and office building in North Bay. A contract has been let to **Carrington Construction Co.,** Sudbury. The new plant will turn out a wide range of diamond core drills, blast hole drills, and supplies.

Ward & Ward, assayers at Auburn, Calif., announce a new location of their laboratory at Union and Chamberlain Streets, Auburn, where they are equipped to do ore testing as well as assaying.

Western Machinery Co. and **Western-Knapp Engineering Co.** announce that **Western Machinery Co., S. A.,** Mexico, D. F., is the exclusive distributor of their products and services in Mexico and Central America. **Stanley Moos** is president and general manager of the Mexican concern, which is an entirely separate entity.

BULLETINS

Gate Valves. Latest developments in lever-operated gate valves are described in a new 16-page bulletin, No. E-150, published by Everlasting Valve Co., 40 Fisk St., Jersey City 5, N. J.

Transmission Belting. A new catalog section on its line of transmission belting has just been published by B. F. Goodrich Co., Akron, Ohio.

Tire Maintenance. The B. F. Goodrich Co. also has just prepared a thoroughgoing 38-page booklet on "How to Save Money on Industrial Hauling Jobs and Equipment." Tire selection and maintenance are discussed.

Blacksmith's Helper. A booklet describing the McKiernan-Terry Blacker power hammer, referred to as the mechanical blacksmith's helper, is available from McKiernan-Terry Corporation, Park Row Bldg., New York 7, N. Y.

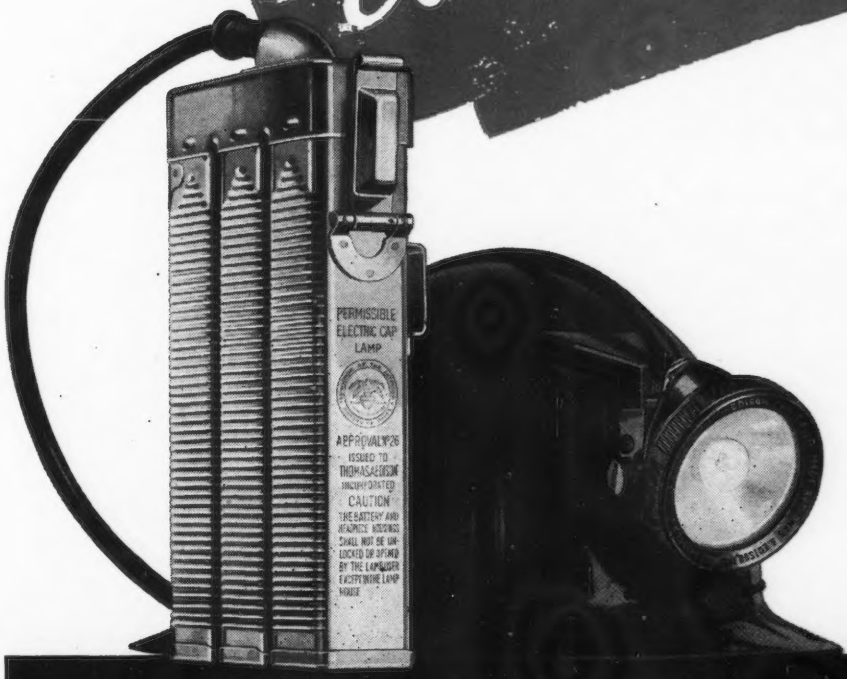
Diesel Engines. A well-illustrated booklet describing diesel engines ranging from 750 to 8,500 hp. in size is available from Nordberg Mfg. Co., Milwaukee 7, Wis.

Tractor Tools. Selection of proper tractor tools is discussed in a folder just published by R. G. LeTourneau, Inc., Peoria, Ill.

Valve Renewal. A valve chart showing how to repair and renew brass and iron valves is available from Reading-Pratt & Cady Division, American Chain & Cable Co., Inc., Bridgeport 2, Conn.

WITH A HERITAGE OF GENIUS . . .

Thomas A. Edison



. . PROVED IN PERFORMANCE ON THE JOB:

EDISON ELECTRIC CAP LAMPS

. . . and M. S. A. SKULLGARDS

The *first* miner's safety electric cap lamp produced by the illustrious inventor, Thomas A. Edison, had a special place in Mr. Edison's records of achievement, for it meant lives saved . . . injuries averted . . better working conditions for an ever-growing number of men whose lot was hazardous labor underground.

Today's Edison Electric Cap Lamp employs the unique, basic principles of its pioneering predecessor—yet is infinitely advanced in brilliant illumination, strength of construction, complete dependability, unequalled length of life. Steady development in the Edison tradition has won for this great product its dominant popularity in mines throughout the world—with over *six hundred thousand* Edison Electric Cap Lamps—now aiding safer production with M.S.A. Skullgards for better head protection.

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MINE SAFETY APPLIANCES CO. (S. A.) (PTY) LTD.
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PERSONAL NEWS

William N. Matheson, Jr., has been made assistant to vice president of the Oliver Iron Mining Co., effective Nov. 16.

D. C. Pettyjohn, Crosby, Minn., general superintendent of the Evergreen Mines Co., has retired after a quarter of a century of iron mining.

Avery Reed, mining engineer, formerly employed by the U. S. Bureau of Mines on the Arkansas Bauxite Project, has been appointed general superintendent with Gilbert & Hageman Co. of Winchester, Ky. The company operates a group of fluorspar mines in the central Kentucky fluorspar district.

James A. Marsh, consulting geologist formerly with the mine exploration division, U. S. Bureau of Mines, has been appointed consulting geologist to the Utah State Land Board. He will fill the position held many years by the late **E. H. Burdick.**

Philip J. Shenon, of the U. S. Bureau of Mines, who has been on an extended geological mission for the U. S. Army in the Pacific, has concluded that work and returned to his home in Spokane. He formerly was head of the U.S.G.S. in Spokane.

Grover E. Le Veque, vice president of the Interstate Iron Co., has changed his address from Pittsburgh to Virginia, Minn., on the Mesabi range.

Paul W. Clymer has resigned his position as field supervisor for the Department of Labor and Industries of the State of Washington to serve as branch manager for the Safety & Supply Co., Spokane, Wash.

Capt. Henry Eplett, of the Newport mine, Ironwood, Mich., retired on Nov. 16 on his 70th birthday. He has been employed at the mine since 1891. He will be succeeded by **Robert P. Brenner**, employed in the engineering and operating department since 1936.

Charles Will Wright has left the service of the government to accept a position with Ventures, Inc. He is to be stationed in Washington temporarily, his address being 109 Brookside Drive, Chevy Chase, Md.

R. H. Downer has been elected secretary of the New Mexico Miners and Prospectors' Association, with offices at 10 Barnett Building, Albuquerque, N. M.

Allen E. Agnew was transferred on Dec. 1 to the Ground Water Division, Water Resources Branch of the U.S. G.S., with headquarters at the Iowa Geological Survey in Iowa City.

W. Randolph Green, widely known over the Pacific States and British Columbia as a mining consultant and for the past three years assistant to the supervising engineer for the U. S. Bureau of Mines at Spokane, is the new geological development agent for the Great Northern Railway serving this area. He will take the place of **A. J. Haley**, who is in military service.

Kenyon E. Richard, chief geologist during several years for the Consolidated Coppermines Corporation at Kimberly, Nev., has resigned to take a position with the American Smelting & Refining Co., with headquarters at San Francisco.

Frank J. DeMel, construction superintendent for the Getchell Mine, Inc., in Humboldt County, Nev., has been appointed superintendent of the 1,000-ton cyanide mill, succeeding **George H. Wigton**, who has resigned to take his former position of metallurgist and mill superintendent for the Dayton Consolidated Mines Co. at Silver City, Nev.

L. Kenneth Wilson, geologist for American Smelting & Refining Co., and formerly stationed in Salt Lake City, has been appointed chief geologist for the Southwestern Mining Department, 813 Valley National Building, Tucson, Ariz. His residence address is 921 North Second Ave. **W. H. Loerpabel** is general manager of A.S.&R.'s operations in the southwest states.

Dr. Carl Tolman, head of the department of geology, Washington University, has been elected chairman of the St. Louis section of the American Institute of Mining and Metallurgical Engineers.

Thomas H. Murdock has resumed his duties as assistant geologist with the North Carolina State Department of Conservation and Development, Raleigh, N. C.

John H. Wells, mining engineer, has joined the staff of Dietrich, Morse & Associates, metallurgical and mining engineers, 316 Sixteenth St., Sacramento 14, Calif.

S. E. Zelenkov has been made superintendent of the Leadville-Kokomo branch of A.S.&R., with offices at Leadville, Colo.

Frank A. Forward, professor of metallurgy at the University of British Columbia, has succeeded **J. M. Turnbull** as head of the department of mining and metallurgy at that institution.

R. S. Weaver has joined the staff of United Clay Mines Corporation at Trenton, N. J., as chief engineer. He was recently mine superintendent for U. S. Gypsum Co., at Gypsum, Ohio.

Howard H. Utley, of Baxter Springs, Kan., second vice president and local manager of the St. Louis Smelting & Refining Co., has retired as head of the operations of the company in the Tri-State district.

Lieut. Rudolph Ekar, who enlisted in the U.S.N.R., has returned to his home in Chisholm, Minn. Mr. Ekar has resumed his work in the mining division of the Division of Lands and Minerals, Minnesota.

William L. Batt has been reelected chairman of the board of the American Management Association.

Henry B. Van Sinderen recently resigned as president of Callahan Zinc-Lead Co. and was elected chairman of the board. He has been succeeded by **Joseph T. Hall**, recently released from the Army with the rank of major.

Ing. Antonio F. Pastor, director of *Industria Minera*, official organ of the Argentine Chamber of Mining, in Buenos Aires, advises us of the completion of the fourth year of his direction of that publication. Congratulations are herewith extended.

Alfred H. Bebec has been appointed general manager of the Golden Cycle Corporation at Colorado Springs.

A. C. Johnson, chief of the Boulder City Division, Mining Division of the U. S. Bureau of Mines, advises that that division has been moved to Reno, Nev., and that the designation is now the Reno Division, Mining Branch. Mr. Johnson's headquarters are at the University of Nevada. The postoffice address Box 1551, Reno, Nev.

Dr. Claude E. Needham of Washington, D. C., editor of the U. S. Bureau of Mines "Minerals Yearbook" since 1942, has been appointed supervisor of the Metal Economics Division's office at Salt Lake City, Utah, where he also will act as coordinator of work done in the three other Western offices at Denver, Colo., San Francisco, Calif., and Joplin, Mo. **George E. Woodward**, supervisor of the Salt Lake City office since 1940, has been named supervising engineer of the Denver office, a position held by the late Charles W. Henderson. **Alfred L. Ransome**, lead and zinc economic specialist in the Washington office, has been designated supervisor of the San Francisco office, a position vacant since last April when **Charles White Merrill** was appointed chief of the Metal Economics Division at Washington with supervision over all of the Division's field offices.

OBITUARIES

Homer K. Sherry, 57, vice president and manager of the Canadian Johns-Manville Co., Ltd., Asbestos, Que., died at Montreal on Sept. 30 last.

Selwyn Gwillyn Blaylock, 67, for 46 years associated with Consolidated Mining & Smelting Company of Canada, Ltd., and chairman and former president of the company, died at Trail, B. C. on Nov. 29.

Capt. Ralph Keeler, for many years prior to Pearl Harbor Philippine correspondent for *E.&M.J.*, mining editor of the *Manila Daily Bulletin* and of the *Philippine Mining Yearbook*, was, according to a late report, lost when a Japanese prison ship was sunk on Dec. 15, 1944. He joined the Intelligence Service in the Philippines in 1940 and was taken prisoner in 1942 after having been wounded in action.

Lieut.-Col. George G. Blackstock, 53, formerly executive vice president of Steep Rock Iron Mines and associated with various other Canadian mining companies, died in Toronto on Nov. 9.

Howard Willey, for the past ten years general superintendent of the Charcas unit of the Mexican Mining Department of the American Smelting & Refining Co. at Charcas, S.L.P., Mexico, died in Atlanta, Ga., on Nov. 12, at the age of 51.

Lester J. Hartzell, 74, professor emeritus of chemistry at the Montana School of Mines at Butte, died Nov. 7. He had resided in Butte for more than half a century and was on the School of Mines faculty for 41 years.

Dr. Borsey Alfred Lyon, 74, metallurgist and director of the University of Utah engineering experimental station from 1927 to 1935, died Oct. 15 at Palo Alto, Calif.

Walter K. Yerston, 64, who was instrumental in building the old narrow gage railroad to Alta, Utah, and former Salt Lake City, Utah, mining engineer and promoter, died Oct. 11 in Reno, Nev.

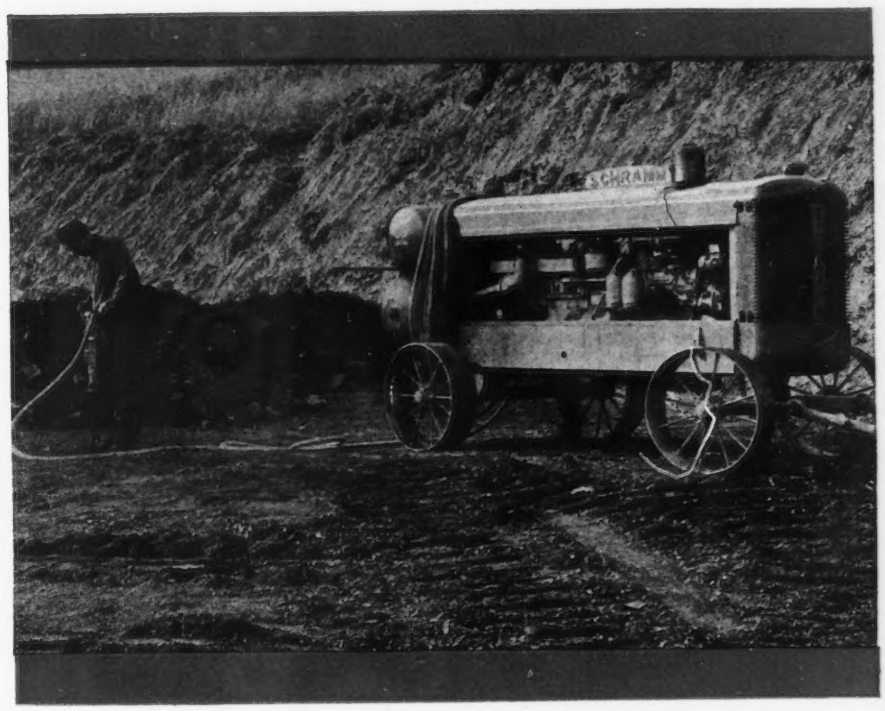
Oliver M. Shosted, 58, field engineer for 22 years for Combined Metals Reduction Co. of Dauer, Utah, died Oct. 10 at Bingham.

Eric Nielsen, 66, superintendent of the Park Utah Consolidated Mining Co. for 30 years, died Oct. 25 at Park City, Utah.

William H. Paul, consulting engineer and mining operator in Colorado, died on Oct. 20.

Roy McVeigh, of Superior, Ariz., a mining engineer employed by Magma Copper Co. for 18 years, died at Tucson, Ariz., on Nov. 27.

Philip Wiseman, a mining engineer active in the West for half a century in the promotion and development of copper mining, died recently in Los Angeles at the age of 79.



4 REASONS WHY MINES SPECIFY SCHRAMM AIR COMPRESSORS

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2. COMPACT — LIGHTWEIGHT
3. MECHANICAL INTAKE VALVE
4. FORCED FEED LUBRICATION

There are many compressed air jobs to be done by Coal Mines, and into this versatile picture fits the Schramm Air Compressor. Its features enable compressed air jobs to be done quickly—easily—economically!

Illustrated here is a drilling job, one of many applications for Schramm Compressors. They are designed for heavy duty, continuous service, with minimum attention.

Schramms are built in sizes ranging from 20 to 600 cu. ft. displacement in every type of mounting and assembly. Start your compressor planning by writing for detailed literature and features of Schramm Compressors, both stationary and portable.

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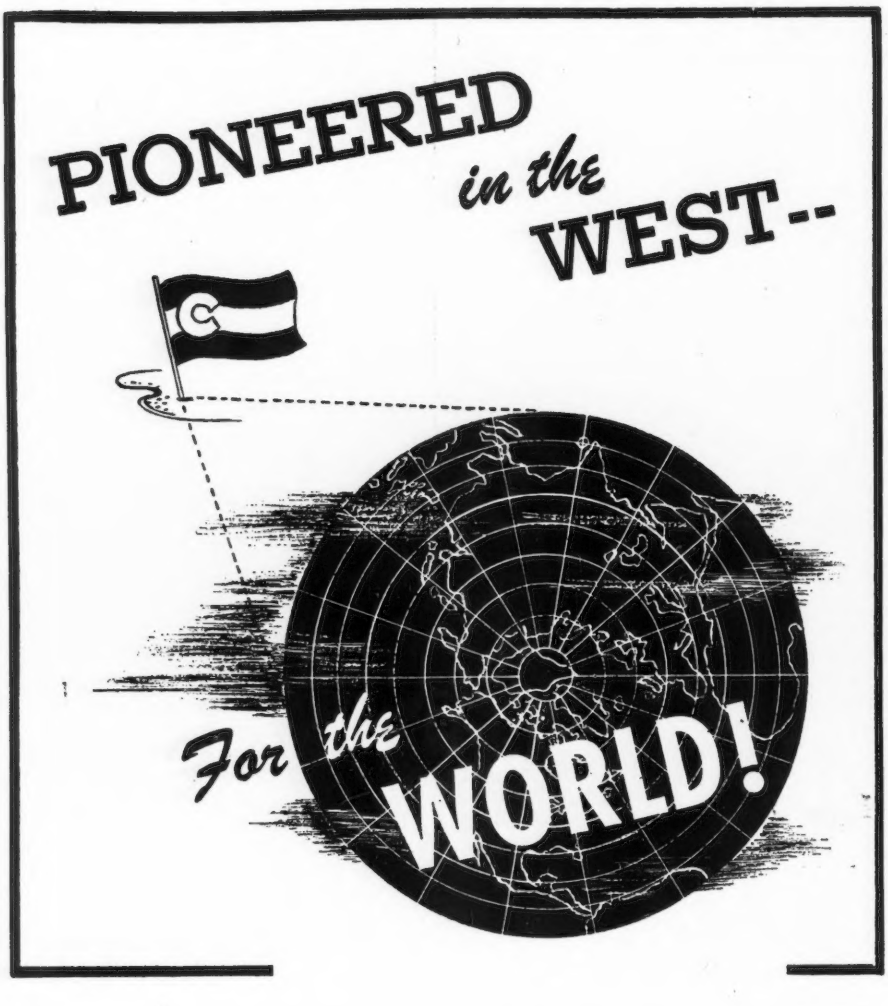

Since 1876—when Colorado entered the Union—The Denver Fire Clay Co., has been "Meeting the Assayers' Need" with top quality merchandise. Then, in the West . . . Today, thruout the World.

Because of our full range of products, assayers everywhere find that we are "The Technical Man's Department Store." Remember this when you need asbestos gloves, chemicals and reagents, mullers, samplers, sieves, and tongs, as well as Assay Furnaces, Crushers, Pulverizers and Metallurgical Clay Goods.

"DFC" on the package means satisfaction on the job!

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LETTERS

Philippine Mining Revival Possible, With Investment and Engineering Initiative

The Editor:

In your letter of May 28 you mentioned that your "readers are deeply interested in knowing in what state the Philippines mines are, or will be, upon recovery from the Japanese; also the opportunities for investment and employment in Philippine mining."

At that time it was premature to give a picture of actual conditions, as very few people had been able to visit the various camps. Since then, I have talked with representatives of most of the important mining companies who have visited their properties, and learned considerable of the condition in which the Japanese left the underground mines and surface improvements.

As you probably know, the Japanese were not interested in gold and made no attempt to operate even the high-grade mines, but did carry on active work at the chrome, manganese, copper, and iron mines. They stripped most of the gold properties of machinery to increase production at the chrome, manganese, copper, and iron producers.

At the beginning of the war, in December, 1941, the American Army commandeered considerable rolling stock and other equipment from the various mines, and also ordered demolition of wharfs and loading facilities at various properties. Some of this was replaced by the Japanese, but not all. When the American Army returned in 1945, the Japanese on their final departure destroyed as much as time permitted at each individual camp. The damage therefore varies at each mine. Some suffered a total loss of surface installations; others only partial destruction.

Rehabilitation of the mining industry has been slow for a number of reasons. In the first place, most of the mining camps are in the hills, and until very recently, the hills were not cleared of Japanese. In the second place, the banks did not reopen until some time in June. A few are not open yet. Also, bank accounts in America were, and still are, frozen. Consequently, practically no money from the States was available for mining purposes.

Many of the gold producers were hestitant to resume before learning something of the possible future of gold, and also most of them will have to finance their properties in one way or another.

In the several years prior to the outbreak of the Japanese war, freight rates on ores to the States rose rapidly from a low of $6 to a high of $18 in December, 1941. Since the close of the war, the War Shipping Administration has set a rate of $12 plus 35 percent to the Pacific Coast,

and $14 plus 35 percent to the Atlantic seaboard. In view of the competitive prices for chrome, manganese, and copper in the States, which are considerably below the ceiling prices set for these metals by the Washington Government, it is impossible for Philippine producers to pay the above-mentioned freight rates and sell their products at a profit in the American market.

At the same time, the newspapers announce that 30,000 tons of shipping space will be available from the Philippines to the United States this month, and 45,000 tons next month. It is said that sea water and sometimes mud have been taken on as ballast in Manila and hauled to San Francisco. Instead of such an economic waste, would it not be advisable for a ship with a cargo space of 10,000 tons to haul 10,000 tons of chrome or manganese ore at $6, which would be $60,000? This would pay a great deal in wages and other expenses instead of hauling unprofitable sea water. Owing, therefore, to the exorbitant freight rates, Philippine producers cannot take advantage of this space, and the ships will continue to return to the States practically empty, just as they have been doing for the past six months. Unless freight rates are reduced to a reasonable figure, the only alternative will be to ship the ores in foreign boats or ships under Philippine registry.

The iron producers, who formerly sold their ore to Japan, are, of course, also ruled out on account of the freight rate to America.

Lack of adequate transportation, and difficulty in obtaining fuel, have been a tremendous handicap up to the present time. Without transportion, it is impossible to carry food to camps which are distant from farming areas.

The two largest gold mining companies, in the Baguio district, have started a clean-up program, and are now employing 30 men in one mine and 60 in another. The miners are working for 1.50 pesos a day and arrangements have been made to purchase food at reasonable prices.

At a third mine the miners have offered to work for 1.25 pesos a day, providing some arrangement can be made to make food available for purchase.

Ordinarily, the mining industry employed about 50,000 Filipinos and 1,500 Americans, most of whom have returned to the States. The 50,000 Filipinos (assuming five to a family) would support around 250,000 people. Aside from these, there are thousands employed in farming, weaving cloth, supplying native building materials for homes, and other products, who service the miners and their families. As the mines are scattered all over the islands, resumption of work at the various camps would mean general rehabilitation.

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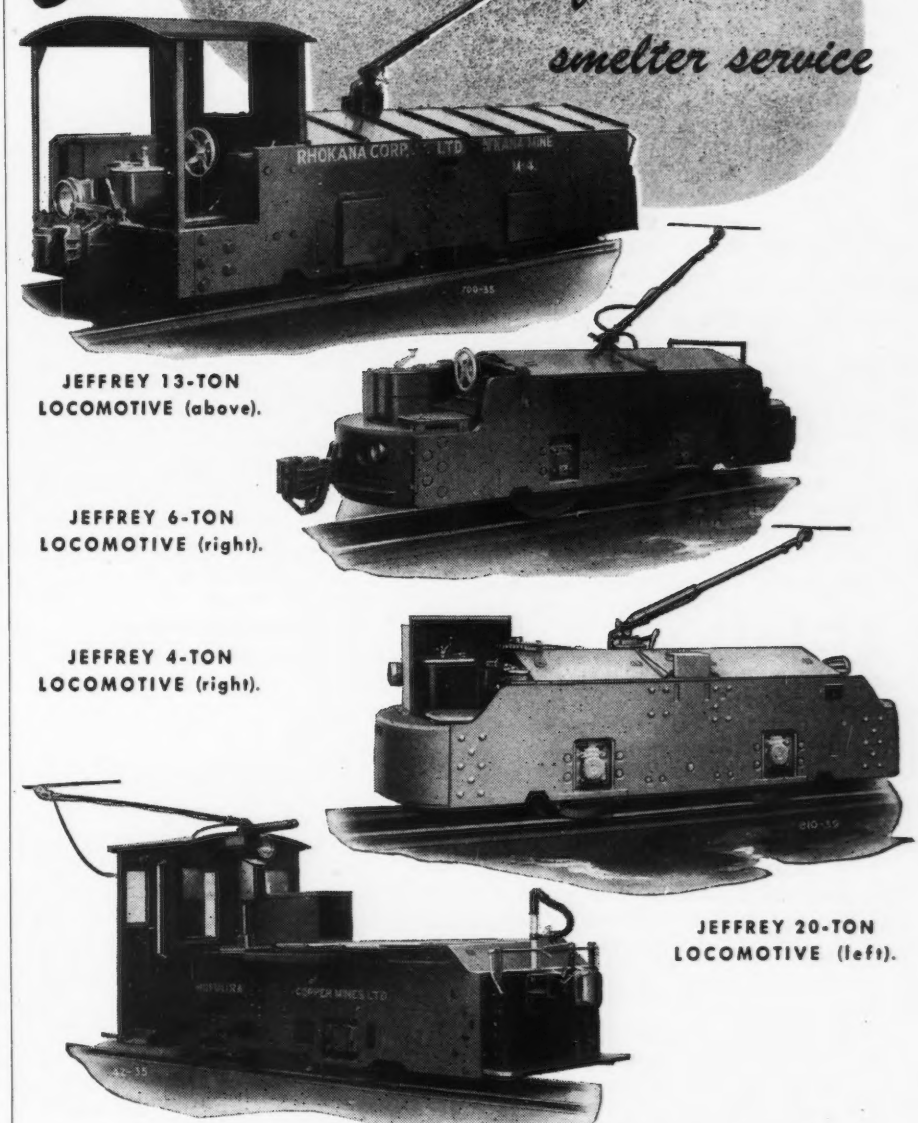

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and even now, Filipino miners are coming in almost daily, offering to work just for their food, and are willing to have the balance of their wages carried on the company books until cash is available.

A number of other companies besides the Baguio mines would like to commence rehabilitation programs, but are confronted with financial problems. Practically all have large claims for war damages, but a number also have claims for equipment commandeered by the U. S. Army in December, 1941, and property ordered destroyed by the same agency. Such claims are in an entirely different category to war damages, and are covered by receipts, vouchers, affidavits, and similar evidences of obligation. If settled promptly, the money would be of great assistance in carrying out a clean-up program.

It has been estimated that it will take approximately 100,000,000 pesos to rehabilitate the mining industry and restore it to the same condition as before the war. As a matter of fact, this is not a large sum considering the ore reserves of the 30-odd mines which were producing in 1941.

During the Japanese occupation, some Americans and many Filipinos roamed the hills and mountains individually and as guerrilla bands, and in avoiding the Japanese units traveled over much formerly unexplored country, and have undoubtedly seen prospects which they intend to locate at a later date, when transportation is restored and facilities are again opened up for the registration of mining claims. This may eventually result in the development of a number of new mines.

In addition, there appears to be at least one property which might develop into a large copper porphyry. Several engineers have recommended that it be drilled, and they believe it has the earmarks of developing a large tonnage.

Aside from assisting in the refinancing of properties and the development of new mines, there is an investment possibility in the construction of metallurgical works near the Maria Cristina Falls, in western Mindanao, for the manufacture of ferrochrome and ferromanganese. The Philippine Government is planning to construct a hydroelectric plant at the falls, and very cheap power will be available. The falls are not far from the coast, where the metallurgical plants might be located. Abundant iron, chrome, manganese, magnesium, and aluminum ores are available close to the island seaports and could be transported by water from the mines to the plants. It has been estimated that ferrochrome and ferromanganese could both be produced at a very reasonable cost.

The foregoing presents a picture of the Philippine mining industry as it is today.

CHARLES A. MITKE.
Manila, P. I., Oct. 22, 1945.

Improved Flotation of Non-Sulphide Minerals

(*Continued on page* 95)

composition of the epidermis and the dermis with a structural form that makes the best use of the available chemical composition.

Fig. 10 diagrams the effect of change in contact angle on wetting of the surface in the case of a fine structure of tapering ciliae: the spaces between are small enough to permit surface forces to be effective.

Not all minerals present the same type of surface, but in addition it must be remembered that size of crystal makes a difference. For example, pyrite, which is isometric and often coarsely crystalline, floats much faster, more completely, and with less reagent than does marcasite, which is orthorhombic, usually finely crystallized, and presents a dull hackly fracture. In an ore containing the two in fairly fine intergrowth, a ready separation was regularly obtained as between free pyrite, locked pyrite-marcasite, and free marcasite even when the aim was to float both simultaneously.

Fig. 11 shows the same effect. Use of a hydrocarbon oil so modifies the surface of the copper screen that the effect of a smooth surface is produced and an improved contact angle results. I believe that the utility of hydrocarbon oils in flotation is in part related to this phenomenon of smoothing rough surfaces. Yet it is likely that hydrocarbon oils have two other effects: (1) to isolate a mineral surface from a pulp, and (2) to permit and promote formation of oil-fastened particle clusters or "oleogregs."

In the case of very porous minerals, such as the Florida pebble phosphate, the large extent of internal surface would consume much collecting agent. And because collector anions would be displacing other anions, concentration of the latter in solution might rise prohibitively. But by using a hydrocarbon oil with the collecting agent, by dissolving the collector in the oil, or by emulsifying collector and oil, it is possible to close the surface to excessive ion exchange once the most accessible sites are taken up. In thick pulps and relatively concentrated collector solution, the reaction can be accelerated, with the greatest gradient in extent of anion exchange between outside and core of each grain. Emulsification of the hydrocarbon is also facilitated by the procedure indicated.

The third function of the oil, that of making oleogregs, is well brought out in the case of a Cuban manganese oxide ore. Under plant conditions on that ore, the pulp is dispersed. By addition of fatty acid and oil, it is possible to create selective oleogregs of the manganese minerals, thicken them, and then discard a slime overflow at about 4 percent Mn ahead of flotation. The ore runs 20 percent Mn.

I believe that the chemical structure of the hydrocarbon oil plays a part in the three roles I have described, but I know of no investigation of that possibility. In fact, the whole subject of oleogregs, pneumogregs, oleo-pneumogregs, and other forms of clustering of particles in polyphase systems is one of great practical, as well as scientific, interest.

Particle Size

It is well known that very coarse and very fine particles are undesirable in flotation systems. The very coarse are likely to be locked or may be so heavy as to fall from bubbles; the very fine have only a poor chance of making contact with air bubbles.

Coarse particles may be crushed finer, but slimed mineral presents a problem. Just now the only remedy known is to use a hydrocarbon oil as described in the foregoing paragraphs.

Summary

The flotation of non-sulphide minerals is primarily dependent upon:

(a) the ionic character of surfaces of the minerals when present jointly in water;

(b) preferential exchange adsorption of hydrocarbon ions at the surfaces;

(c) the extent of surface on the various minerals;

(d) the relative roughness of surface on the various minerals;

(e) the size of the particles.

Most of this control is chemical in nature, depending on addition of reagents or removal of dissolved impurities. But some non-chemical control is also possible, such as better preparation of size of particles, desliming, reduction in locking by suitable regrinding procedures, and selection of the best adapted kind of flotation cell.

I wish to acknowledge the help of Messrs. Will Mitchell and S. C. Sun in the preparation of certain drawings used with this article.

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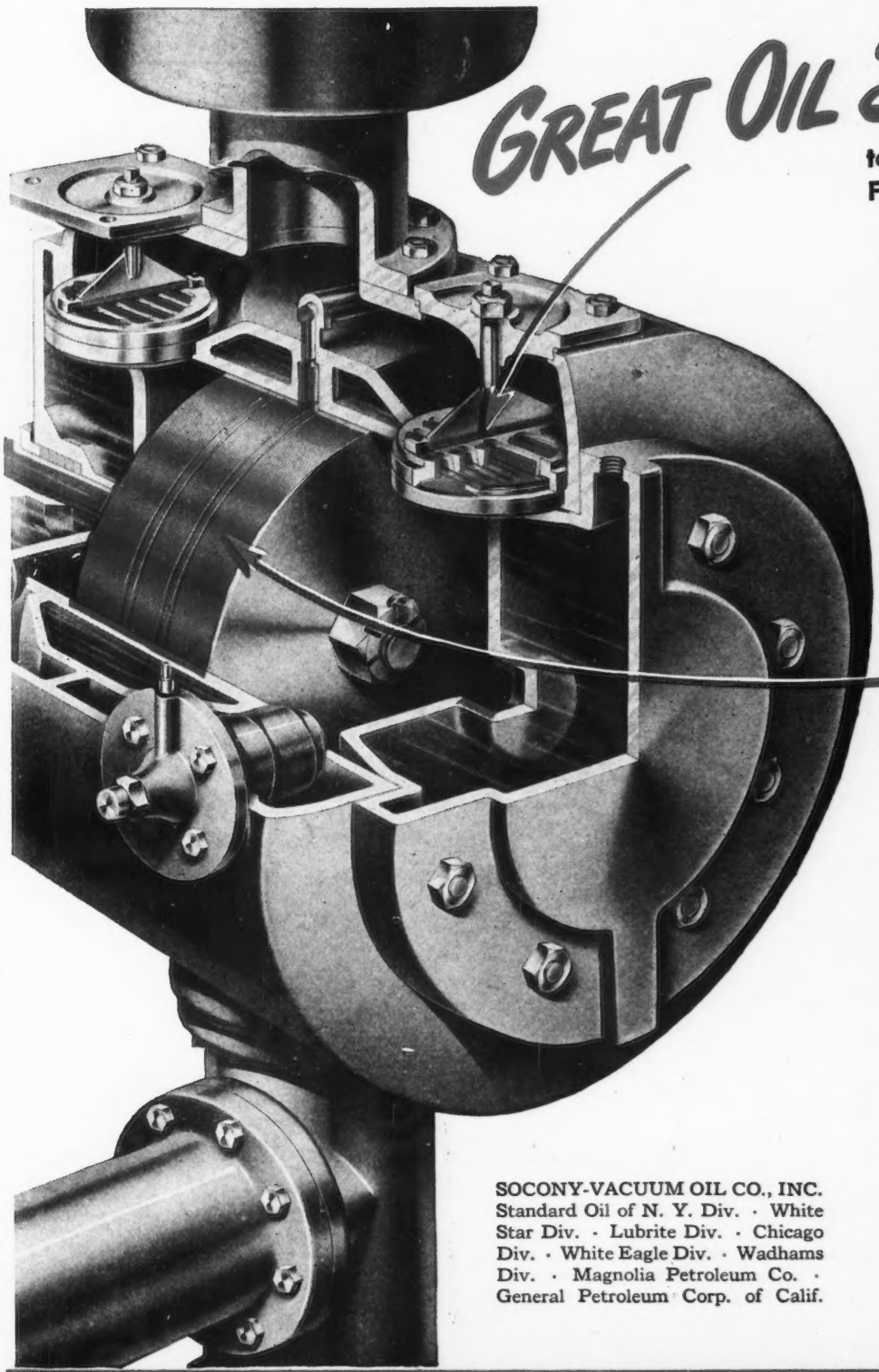

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NEW BOOKS

ELECTRONIC EQUIPMENT AND ACCESSORIES. By R. C. Walker. Chemical Publishing Co., Inc., Brooklyn, N. Y. Pp. 393. Price $6.

The volume offers considerable specific information on the various applications of electronic devices to practical engineers, mechanics, and students acquainted with the elements of electricity and magnetism. In the 15 chapters dealing with such subjects as thermionic valves, amplification of steady and low-frequency voltages, application thermionic valves, gas-filled valves, application of gas-filled triodes, and numerous others much practical and illustrative information is given. The appendix contains many examples of mathematical formulas and problems, and tables helpful to those interested in electronic engineering.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE, Eighth edition, Lincoln Electric Co., Cleveland, Ohio. Pp. 1282. Price $1.50 in U. S. A., $2 elsewhere.

Designers of mine plant structures and mechanical equipment will want this book within reach of the drafting table. More than 300 pages are devoted to the design of arc-welded structures, and over 200 to the design of fabricated machine elements. Other topics fully discussed are the technique of welding, welding procedures and costs, weldability of metals and typical applications of arc welding. Generously illustrated with line cuts and halftones, the text is a good practical review of structural design. Typical problems analyzing stresses in structural joints and members are well presented. A compilation of useful reference tables concludes the handbook.

BALL AND ROLLER BEARING ENGINEERING. By Dr. Ing. Arvid Palmgren. Published by SKF Industries, Inc., Philadelphia, Pa.

As a fundamental text on all phases of bearing applications to industry, Dr. Palmgren's volume will prove most helpful to those interested in the design, construction, and maintenance of ball bearings, as well as a valuable addition to the plant, engineering school, and college libraries. The book commences with a technical description of common bearing types. Fundamental engineering studies are discussed and explained in the succeeding eight chapters. Chapter 1 is devoted to a discussion of radial and thrust bearings, supplemented by data on dimensional proportions, running accuracy, and tolerance of each type. Forces and motions in bearings are treated in Chapter 2. In it are given theory and calculations on such subjects the nature of rolling resistance, friction torque, friction coeffcients, stresses and deformations, load distribution, motion, and inertia. Succeeding chapters deal with studies in the carrying capacity of ball and roller bearings, bearing selection, design of bearing applications, mounting and dismounting, lubrication and maintenance, and bearing failures. Tables, conversion values, and a description of symbols and abbreviations are given in the final chapter. First copies of the book are being sent by SKF to the heads of leading corporations, technical schools, and colleges and libraries in the principal United States cities. Later editions will be sold at cost by the company for students and others interested in bearing studies.

PUBLICATIONS RECEIVED

California Journal of Mines and Geology. Vol. 41, No. 1, January, 1945, Division of Mines, Ferry Building, San Francisco, Calif. "Quicksilver Deposits of Central San Benito and Northwestern Fresno Counties, Calif.," by R. G. Yates and Lowell S. Hilpert, geologists, U. S. Geological Survey, and "Wartime Mineral Industry of California," by Spangler Ricker, district engineer, Western Region, U. S. Bureau of Mines, San Francisco, Calif., are the principal subjects covered in the bulletin. Pp. 72.

"Powder Blast Mining in Conjunction With Long-Hole Blasting," by Howard M. Fowler. Bulletin School of Mines and Metallury, Rolla, Mo. Pp. 12.

"Some Magnetite Deposits of Stevens and Okanoga Counties, Wash.," by W. A. Broughton. Report of Investigation No. 14, Division of Geology, Department of Conservation and Development, Olympia, Wash. Pp. 24. Price 25c.

"A Technique for Making Torsion Balance Surveys of Inundated Areas," by K. F. Hasselmann. Bulletin School of Mines and Metallurgy, Rolla, Mo. Pp 31.

"Geology of Red Deer and Rosebud Sheets, Alberta," by John A. Allen and J. O. G. Sanderson. Report No. 13, Research Council of Alberta, University of Alberta, Edmonton, Alberta. Pp. 109, Price 75c.

"Asbestos and Jade Occurrences in Kobuk River Region, Alaska." Pamphlet No. 3, Department of Mines, Territory of Alaska, Juneau.

"Sillimanite and Massive Kyanite in Georgia." Preliminary Report by A. S. Furcron and K. H. Teague. Bulletin 51, Department of Mines, Mining and Geology, Atlanta. Pp. 76.

"Geologic Literature of New Mexico Through 1944." By R. L. Bates and M. R. Burks. Bull. 22, Bureau of Mines and Mineral Resources, Socorro, N. M. Milling Plants in Canada. Part I. Bureau of Mines, Ottawa, Canada.

"Design Specification for Stress-Grade Lumber and Its Fastenings." National Lumber Manufacturers Assn., Washington, D. C. Price 25c.

"Postwar Fiscal Requirements: Federal, State, Local." By Lewis H. Kimmel and Associates. The Brookings Institution, Washington 6, D. C. Pp. 166. Price $2.

"Mica." (1) Index map of mica mines in northwest Randolph County, Ala. on file in the Survey offices in Washington, D. C., and in Crane Bldg. Asheville, N. C.; also in office of State Geologist, Atlanta, Ga. (2) Index map of Upson County mines and Carter mine, Georgia. On file in the Survey offices in Washington, D. C., and in Crane Bldg., Asheville, N. C.; also in office of State Geologist, Atlanta, Ga. (3) Map of Charles Davis mica mine, Grafton County, N. H. On file in the Survey offices in Washington, D. C.; and at Silsby Hall, Hanover, N. H. (4) Maps of MacArthur and Victory mica mines, Custer County, S. D. On file at the offices of the Survey, Washington, D. C., and Custer, S. D.; also in office of State Geologist, Vermillion, S. D.

Brazil. The National Department of Mineral Production, at Rio de Janeiro, has recently issued the following bulletins, among others (written in Portuguese):

"Deposits of Nickel and Cobalt of Sao Jose de Tocantins, Goias." Pp. 69, with maps.

"Tungsten in Paraiba and Rio Grande do Norte." Pp. 37.

"Rock Crystal in Cristalina, Goias." Pp. 28.

"Preliminary Note on Tin Region of St. John del Rey, Minas Gerais." Pp. 26.

"Preliminary Note on Tungsten Deposits, in Sumidouro, Mariana-Minas Gerais." Pp. 42.

"Deposit of Gold-Copper-Antimony Ore of Bico de Pedra, Rodrigo Silva, Ouro Preto." Pp. 27.

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REGIONAL NEWS

COLORADO

Gold and silver shipments to mine increase—State fluorspar reserves estimated

★The Denver mine received a total of 24,705,594 oz. of gold in October, showing a slow but steady pickup in gold mining for Colorado and the region. The total received in October 1944 was 15,271,434 oz. Values of gold shipments for October in 1945 and 1944, were $864,695.82 and $534,500.22, respectively, an increase in values of more than 60 percent. Moses E. Smith, mint manager, also revealed that the mint received 10,004.98 oz. of silver in October 1945, worth $6,788.41, against 7,419.43 oz. in October 1944, worth $5,074.34 Mr. Smith said the gain in silver was largely due to the presence of silver in predominantly gold ores. He said the mint is now getting gold from some operations in the Colorado and Rocky Mountain regions that haven't shipped for years. Gains were especially noteworthy from the Telluride and Cripple Creek district, and were marked from Montana and Alaska. Some of the gain from Cripple Creek is due to the fact that shipments during the war were largely made from low-value dump ores, and that shipments are now working into good ore stockpiled during that period, and also from new ores being mined in increasing quantity.

★The Monte Cristo zinc-lead mine, in Summit County north of Hoosier Pass, a high-altitude operation on the slopes of Mt. Quandry, has again been closed for the winter. It is owned by the Golden Cycle Corporation and has been used to supplement that company's custom purchases of lead-zinc ores for its lead-zinc section of the Colorado Springs mill. The Monte Cristo is an open-pit operation. Power shovels load the ore as blasted direct from the pit, into trucks of the Colorado Trading & Transfer Co., which have been hauling it 60 miles to Buena Vista for loading on railroad cars and shipment to Colorado Springs.

★The Golden Cycle mill is now treating about 300 tons of gold ore daily, in addition to its continuing treatment of about 400 tons of lead-zinc ore daily.

★A party of state and federal officials recently inspected the Mollie Kathleen mine, at Cripple Creek, to determine ways to cope with its bad air problem —the mine was recently closed for 21 consecutive days due to excessive accumulation of nitrogen gases. The party included Capt. A. T. Rossano, of the U. S. Public Health Service, who is working with the state Industrial Hygiene Division; Ed. Holman, of the Colorado Industrial Commission; John Shaw and Arthur Maize, of the Bureau of Mines; Fred Jones, state mine commissioner, and Fred Theobald, district mining inspector. The consensus was that the condition could be remedied—except for occasional days of very low barometric pressure—by changes in the ventilating system. Shirley Johnson is mine superintendent.

SPODUMENE-MICROLITE ore from the Harding mine, near Dixon, N. M., furnishes tantalum metal for use in bone surgery, and other new developments. Ore carries 5 to 10 lb. of microlite per ton. These Humphrey spirals treat 1.5 tons per hour, produce concentrates assaying 68 to 70 percent Ta_2O_5. Tailings are impounded for possible future spodumene recovery. Arthur Montgomery, of New York, operates the Harding; John A. Wood, Dixon, N. M. (in photograph), is general manager.

★Doak C. Cox, geologist of the U. S. Geological Survey, is the author of a study of Colorado fluorspar deposits published by the Colorado Scientific Society in cooperation with state agencies. He estimates total reserves of economically minable ore as on the order of 800,000 tons, or roughly twice earlier estimates, and says that it appears probable this does not include all economic deposits and that further exploration is to be encouraged. Fluorspar has been found at about 50 places in Colorado, but the writer confined his estimates largely to the four districts in which it has been commercially mined—Wagon Wheel Gap, Jamestown, Northgate, and Brown's Canyon.

In intervals between wars, Colorado has been an extremely minor producer of fluorspar, but in World War I its contributions rose to 11 percent of the annual national supply, and in World War II, to more than 12 percent.

★The Bureau of Mines has, at the request of the Navy Department, undertaken an extensive exploration of oil-shale reserves on the Navy's reservation in western Colorado, in conjunction with the mine and retorting mill now under construction near Rifle. E. J. Longyear Co., of Minneapolis, is drilling three exploratory holes, under a contract, for $34,325. The holes are being drilled at the apices of a triangle, one-fourth mile apart, one to be 2,600 ft. deep and the two others 800 ft. deep. The Bureau has also contracted for two NTU-type oil-shale retorts each to treat 40 tons of shale daily, at the mine, to be constructed by the Southwestern Engineering Co., of Los Angeles, for $189,081. The Bureau incidentally has abandoned plans for its 1.5 mile aerial tramway from mine to retorts, and will resort to truck haulage. The Grazing Service and Bureau of Public Roads have authorized the hard-surfacing of the necessary road at an expenditure of $19,000.

★The special grand jury which is investigating the vanadium situation in western Colorado with an eye toward possible anti-trust charges against the two principal producers, U. S. Vanadium Corporation and Vanadium Company of America, was called into session Oct. 29, but adjourned without action, apparently

Colorado (*continued*)

because of the desire of the Anti-Trust Division, and other Government agencies concerned, to make further investigations before laying the case before the Grand Jury. Meanwhile U. S. Vanadium has closed its mine at Rifle and has laid off about half the working force at the mill, a huge stockpile of vanadium on hand, together with reduced demand following the war, being given as the reason.

★Hope is still entertained in Leadville that the Congress will appropriate funds for the partial completion of the deep-drainage tunnel, now at a standstill and in standby condition as a head-end bore, because of the refusal of Congress so far to appropriate the $485,000 necessary to complete the tunnel to the nearest mineralized area. Edward Dickerson, mining engineer, has spent much of his time recently in Washington in the interests of the tunnel.

★Clear Creek Mining Association at a recent meeting approved the bill introduced by Western senators and representatives seeking relief for the gold-mining industry because of shutdowns sustained as a result of Order L-208 of the WPB. The Clear Creek district was especially hard hit because of its dependence on gold and silver mining.

★O. B. Willmarth of Silver Plume reports that he produced 4,000 tons of lead-zinc ore from the Grizzly Gulch mine under WPB-RFC bonus prices, between 1943 and the summer of 1945. He plans to continue winter operation. Two other local operations, the Mendota, operated by a company headed by W. K. Howard, and the Smuggler, operated by C. P. Schreiner, have maintained steady production. The latter is now closed for the winter.

★The Lackawanna mill, near Silverton, has begun steady operation after several months of test runs. P. G. Millkin says it is planned to operate three shifts daily the year round, up to the mill's full 50-ton daily capacity, and that if present plans materialize, capacity will be doubled next summer. This is a United Production Co. (of Denver) operation and handles ore from the Lark and Caledonia mines. The crusher mill will operate one shift daily with diesel power. The mill itself is operated with central-station power from Western Colorado Power Co.

★Colorado Fluorspar Mines, Inc., purchased the property and holdings of the Colorado Fluorspar Corporation during February of 1945, and construction work was immediately started to enlarge the mine and the plant located at Browns Canyon near Salida. Since that time a 5x5 ball-mill, duplex classifier, six flotation cells, and a new 3x30 rotary dryer have been added to the mill, increasing grinding capacity to 125 tons per

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XH-2	Copper Concentrates	Metallurgical	2.5	17.	6.0	8.	Wood
XH-2	Pyrite Concentrates	Metallurgical	5.2	8.7	4.1	7.	Coal
XH-4	Gold Concentrates	Metallurgical	4.2	12.	4.7	12.	Coal
XH-4	Pyrite Concentrates	Metallurgical	6.0	8.5	3.5	11.	Coal
XH-4	Flue Dust	Metallurgical	1.9	31.0	6.5	12.	Coal
XH-8	Copper Concentrates	Metallurgical	4.8	9.5	3.0	16.	Coal
XH-8	Lead Concentrates	Metallurgical	3.85	11.0	3.7	14.	Coal
XH-8	Zinc Concentrates	Metallurgical	4.9	13.5	3.1	15.	Oil
XH-8	Peat	Fertilizer	1.15	65.	21.	14.	Oil
XH-10	Apatite Concentrates	Fertilizer	8.5	15.5	2.1	26.	Coal
XH-10	Lead Concentrates	Metallurgical	6.2	12.0	4.2	22.	Coal
XH-10	Zinc Concentrates	Metallurgical	6.0	10.8	4.3	23.	Coal
XH-10	Zinc Residue	Metallurgical	2.8	37.0	8.0	24.	Coal
XH-10	Refuse	Fertilizer	1.8	57.	12.	21.	Gas

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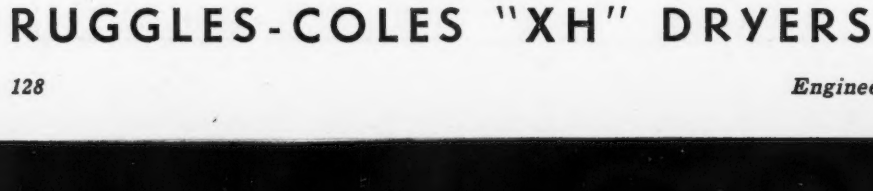


RUGGLES-COLES "XH" DRYERS

Colorado (*Continued*)

day. Two banks of jigs are being installed ahead of the flotation mill to scalp off a waste product, as well as a high-grade metallurgical spar. This operation, which produces ceramic-grade spars, has a daily output of 40 tons of concentrate, analyzing plus 96 percent CaF_2 and 30 tons of metallurgical spar running 85-5 grade. A new 3-compartment shaft was raised out from the bottom level of the mine and a 75-ft. headframe erected above the mill, and a double drum hoist installed. Sinking of another 100 ft. in the shaft is now under way.

A complete new crushing plant was installed and a 200-ton steel ore bin erected.

Colorado Fluorspar Mines, Inc., is a Nevada Corporation. The supervisory staff of which includes: S. F. Wickham, general superintendent, and R. F. Hickman, assistant superintendent.

ARIZONA

Magma Copper reports activities —Eagle-Picher custom mill increases capacity

★The Magma Copper Co., of Superior, made a net profit of $392,501.91 after deducting federal income taxes during the first nine months of this year. A non-recurring profit of $20,058.16 resulting from the sale of securities is included in the profit for the period.

In May 1945 Magma received $330,287.57 for Premium Price Plan adjustments on its 1944 production. After deducting estimated federal income taxes, the net profit from this source is approximately $254,287.57.

During the nine-month period, the company operated on about 60 percent capacity, because of labor shortages. The smelter is being operated intermittently. It produced 12,881,520 lb. of copper during the nine-month period. The milling of zinc was suspended in July 1945. However, 5,119 tons of zinc concentrates were processed at the mill. Extensive diamond-drilling is being carried at the San Manuel Copper Corporation, subsidiary of Magma Copper Company.

★Regular shipments of copper ore are being made from the Control Mines, near Oracle. About 30 men are employed, headed by Robert McKaye, of Oracle.

★Tovrea Packing Co., of Phoenix, is operating its gypsum property on the San Pedro River, between Winkelman and Mammoth. Steady production is maintained.

★The 79 Lead Copper Co., of Hayden, has resumed the shipping of lead-zinc ores to the Shattuck Denn custom

mill at Bisbee. John McKay, of Hayden, is in charge of the operation.

★The State of Texas mine, in the Huachuca Mountains near Bisbee, has resumed shipments of lead-zinc ores to the custom mill of Shattuck Denn, of Bisbee. P. L. Bones is in charge of the operation.

★About 20 men are employed at the Silver Hill mine, operated by the Arizona Copper Bell Mining Co. Regular shipments of copper ores are made to the smelter. J. Bennett is in charge of the mining operation.

★The Rosemont mine is being operated by Alma Greenhaulgh and James Maffeo, of Bisbee. About 10 men are employed and regular copper ore shipments are being made to the smelter at El Paso. The mine is about 30 miles south of Tucson.

★Milling capacity has been increased from 400 to 525 tons at the Sahuarita custom mill of Eagle Picher Mining & Smelting Co. The increased capacity will take care of the lead-zinc ores being shipped from Sonora, Mexico. Neil Parker is mill superintendent.

UTAH

U. S. Supreme Court grants hearing on tax cases—Vanadium Corporation leases Mercur property

★The United States Supreme Court on Nov. 5 granted a hearing to Kennecott Copper Corporation and Silver King Coalition Mines Co. in their action to recover a total of $83,147.76 in taxes paid to the Utah State Tax Commission in 1944 on Government subsidies paid to the two companies in 1943. The Tenth Circuit Court of Appeals, at Denver, on July 23 reversed a decision by the Federal district court, Salt Lake City, in favor of the two mining companies. The majority opinion by the circuit court held that the State of Utah had not permitted litigants to use federal courts, but acknowledged that Utah had waived immunity from suit in State courts. C. C. Parsons, attorney for Kennecott, and R. J. Hogan, attorney for Silver King, are awaiting fixing of a date for the Supreme Court hearing.

★Silver King Coalition Mines Co. announced that for the quarter ended Sept. 30, 1945, it had a profit of $23,793.16 after all taxes and depreciation, but before depletion. Net loss for the year ended Sept. 30, 1945, was $57,920.04.

★Announcement concerning a strike vote conducted by the National Labor Relations Board of nonferrous mining and smelting industry workers in Utah and part of Nevada was expected about the middle of November from the San Francisco office of NLRB.

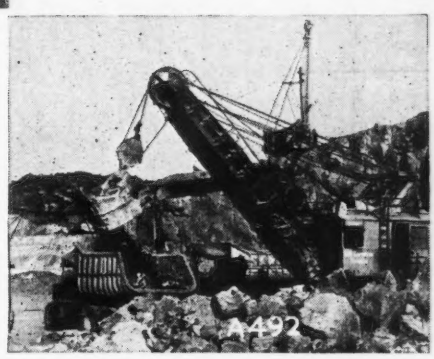
Cooperation with Mine Operators Led to Improved Shovel Performance

The open-pit copper mines have latterly installed faster shovels for stripping overburden and loading ore; and these shovels, because of their speed, powerful crowd and relatively short booms and dipper sticks, have proved to be just too much for the lighter type of dippers that previously had been found adequate.

R-780 Shop view 4½ yd. Amsco Manganese Steel Special Renewable Lip Dipper.

Buckets for the new shovels required great strength to resist heavy pressures and high speed operation; sufficient metal at points of severe abrasion to insure good wearing life; and the proper shape to cooperate with shorter booms and dipper sticks. The shape was also influenced by the nature of the digging, height of the bank and height from which loads were dumped into cars or trucks. Dipper width, lip shape and tooth spacing were also considered. The comparatively short booms and sticks of the shovels required the bucket to fill in a short travel — hence the toothed end of the dipper must offer the least possible resistance to digging and filling.

For three years Amsco engineers spent sufficient time in the mines to obtain the first-hand data necessary to the designing, in close cooperation with superintendents and maintenance men, of dippers adequate to the digging conditions. The new design finally evolved was successful and as a consequence the word has passed from one copper mine to another so that a total of over sixty of these buckets has been ordered, a convincing testimony to an efficient combination of good design with "the toughest steel known."



A-492 The same dipper loading ore at open pit copper mining operation.

Digging and loading of the meanest rock ore on record just after a blast was fired are shown in picture A-492.

How Amsco-Nagle Pumps Readily Cope With Abrasive Tailings and Concentrates and Corrosive Mine Water Is Told in Bulletin 940.

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Factory—Trenton, N. J. Established 1870

Utah (*continued*)

Ballots were mailed to individual employes and had to be mailed back postmarked not later than Nov. 3. Formal request for the strike vote was made Nov. 4 by district union No. 2, International Union of Mine, Mill & Smelter Workers, CIO. The union insisted that wage levels in the Utah-Nevada district be raised to the level of those paid in the Couer d'Alene district of Idaho.

★William J. O'Connor, manager of Utah operations, American Smelting & Refining Co., announced that his company's Murray smelter, closed down last May because of lack of ore, was to be reopened Nov. 15. Two hundred workers will be called back, he said. He estimated that available ore will keep the plant operating until next May.

★The Kalunite, Inc., plant at Salt Lake City, processing Utah alunite into alumina and other products, still was in operation Nov. 8, pending orders from Washington, D. C., according to S. J. Burris, Jr., general superintendent. It had been announced last month that unless plant operators demonstrated before Nov. 3 that they could produce some form of potassium as a byproduct of their alumina process, in volume and at a price to make the plant operation feasible commercially, the plant would be shut down.

★Vanadium Corporation of America has taken a long-term lease on the Mercur Dome Gold Mining Co. property at Mercur, to develop vanadiferous shale, the company's officers announced Oct. 14. The vanadium-bearing shale was found by the U. S. Bureau of Mines just above the Madison limestone at a point west of the 1,000-ft. level of the Mercur Dome incline shaft two years ago. The lease provides for the production of base and precious metals in addition to the vanadium ore, by either the lessor or the lessee, as desired and agreed. If the lessor produces these other metals, a royalty will be paid on them to the Mercur Dome Co. The latter company was formed in 1938. Sam Buckley, of Provo, experienced miner; C. N. Sweet, of Salt Lake City; T. G. Mays, and Zenus Porter sank a 1,000-ft. incline shaft, from which diamond drilling first revealed the vanadiferous shale. Appreciable values in zinc, lead, gold, and silver also were found.

★An active market in many Western silver producers developed during October and November, with transactions at the Salt Lake City stock exchange eclipsing in volume any since February, 1937.

★A. G. Mackenzie, manager, Utah Metal Mine Operators' Association, said silver is a byproduct of most metal-mining operations in Utah, and the price will have to increase more than the recent upward revision of

⅛c per ounce of foreign silver before any radical change in operational policies would be warranted. He pointed out that production of copper, zinc, and lead was decreasing because of manpower shortage and as a result silver production also was declining.

★Utah State Road Commission officials have notified C. Sewell Thomas, consulting engineer for Barber Asphalt Co., that construction of a graveled road from U. S. Highway 40 to the company's gilsonite mine at Bonanza, Uintah County, will be started next spring as early as weather permits. The mine, damaged by explosions and fire Oct. 3, now is producing on normal basis again. Mr. Thomas said expansion plans will be carried out as originally contemplated.

★Points for diamond drilling to determine the extent of anticipated orebodies had been indicated Nov. 3 on the Americus property in Beaver County, under lease to Plumbic Mining Co. The points were indicated to Boyles Bros. drilling contractors by Paul Hunt, president, Tintic Lead Mining Co.; N. Hewett, geologist for Park Utah Consolidated Mines Co., and J. G. Sargent, general manager, Horn Silver Mining Co.

★Utah iron ore output increased to 170,015 tons in August, compared with 148,091 tons in July.

NEVADA

Silver-lead properties are reopened—Cyanide mills are renovated and resume operation

★Newmont Mining Corporation has delivered several carloads of mine equipment at the lead-silver-copper property of the Aladdin Mines Co. in the Bullion or Railroad district, 28 miles southwest of Elko. Newmont's lease and option, taken several years ago, provided for starting work within six months after the end of the war. Ellsworth R. Bennett, Newmont staff engineer, has been at Elko and Bullion from the company's Denver office and indicated full-scale work will not be undertaken until spring. Newmont also has resumed work with a small crew on the old Ward lead-silver mine, in the Ward district, 18 miles south of Ely, where tunnel work was started in 1942 but labor shortage compelled a shutdown in the following year. In charge at the Ward mine is Joseph H. Skidmore, manager, until its closing down, of Newmont's Gray Eagle copper mine, near Happy Camp, Calif.

★Steps are being taken to reopen the Betty O'Neal silver-lead mine, in the Lewis district, 13 miles southeast of Battle Mountain, by Fred Story, who has been manager of mines in that region, under a five-year lease with

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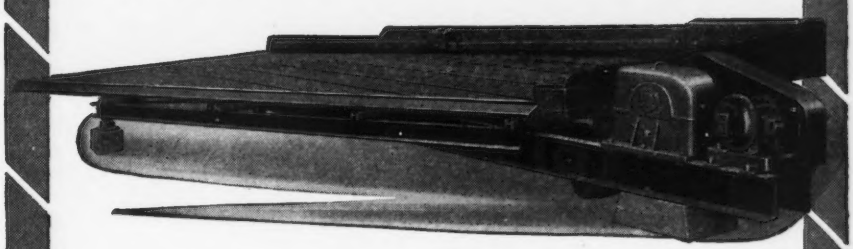

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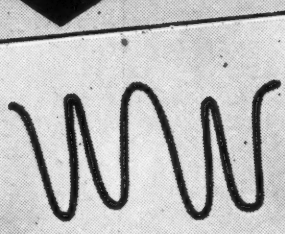

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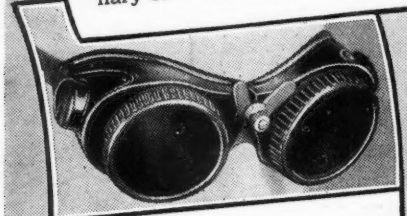

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Nevada (*continued*)

option to purchase. He reports that sampling has shown a substantial volume of mill-grade ore above the level of the 5,000-ft. Getchell drainage tunnel, and a 125-ton unit of the 250-ton flotation mill can be put in efficient operation with minor repairs.

★Mill-feed for the 175-ton cyanide mill of the Dayton Consolidated Mines Co., below Silver City in the Comstock district, closed down for three years and lately resuming operation, will come, for the present, from the open pit on the Keystone mine. Underground production through the New York shaft will be deferred until spring, according to a statement by Homer L. Gibson, of Carson City, managing director, and William J. Henley, of Virginia City, manager. Operation of the mill began in March 1934 and in the eight years prior to Order L-208, it treated 439,614 tons from the company's Dayton, Justice, Keystone, and New York mines, and 77,966 tons of custom ore from mines in a radius of 200 miles.

★Plans are announced for the early reopening of the formerly productive Lucky Boy lead-silver mine, in Mineral County, and operation of the 250-ton flotation mill on company and custom ore. The property is held under long-term lease and option by the Champion City Mines, Inc.

★Property of the South Comstock Gold Mines, Inc., including the long-productive Silver City mine and 150-ton flotation mill, is being operated under lease by Nevada Mining Exchange, Inc. Duard C. Wray, of Silver City, is president and manager. Ore is mined from an open cut after surface stripping with bulldozer in an area traversed by three veins short distances apart and including the Silver City fracture zone, known as the southeast extension of the Comstock lode.

★The old McNaughton lead-silver mine, on Prospect Mountain, in the Eureka district, has been leased and is being reopened by Capt. Arthur A. DeMelik, mining engineer of New York.

★Early resumption of work on its gold property in the Hornsilver district, Esmeralda County, is planned by officers of the Goldpoint Mining Co., Harry M. DeVotie, of Goldpoint, manager. A new orebody of promise was opened before work was halted by Order L-208, according to a report by the president, Lt. Col. F. W. Im Masche, now stationed in Washington, D. C.

★October shipments of mine products over the Tonopah & Goldfield railroad, heaviest in many months, included two cars of silver-gold ore from Tonopah Mining Co. leases, one car from the Jameson lease on the Tonopah Divide mine, seven carloads of old mill tailing from Columbus, 11 cars of diatomite from Basalt, and 46 cars of barite mined by the Chemical & Pigment Co. at Ellendale, 30 miles east of Tonopah.

★A contract has been awarded by the International Mining Corporation to Hall Bros., Inc., trucking contractors of Ely, to deliver 8,000 tons of lead-silver ore from the Groom mine, in western Lincoln County, to the rail point at Calielte, 92 miles east of the mine. Trucks are hauling 60 tons per day when the mine crew can deliver the ore to the loading bins. Dan Sheahan is manager.

★Property of the Fowler-Reeves Corporation, including a large number of lode and placer claims and millsite in Mineral and Nye counties, has been sold by the sheriff at Hawthorne at public auction to satisfy judgment for $84,671 obtained in a suit by Edward H. Fowler against the California corporation.

★A 20-year lease with purchase option involving property of the Tonopah Belmont Development Co., now liquidated, has been obtained by James B. McConnell and associates of El Paso, Tex., from F. W. Handell of Shafter, Calif., represented by T. J. Niceley, of Tonopah. The Gypsy Queen shaft has been opened and a small crew has been preparing the mine for leasing activities.

★Two groups of claims, gold and copper, have been acquired and are to be developed by the newly organized Airlanes Gold-Copper Mining Co., which has plans for immediate construction of a 50-ton pilot cyanide mill at the gold claims in Limerick Canyon, Pershing County. E. C. Bradshaw, of San Francisco, is president and manager, with Martin Judge, Jr., 1 Montgomery St., San Francisco, vice president.

★An old 200-ton flotation plant at Sodaville, Mineral County, known as the Kernick mill, has been remodeled again to treat gold ore from the Marietta district, some 16 miles distant. The mill has been acquired by O. F. Swenson, of Glendale, Calif., who will also endeavor to obtain offerings of custom ore from surrounding districts.

MONTANA

Anaconda experiments with block caving—Montana Bureau outlines two-year plan

★Experiments being conducted by the Anaconda Copper Mining Co. to determine the feasibility of block caving in the Butte district are said to be proving successful. The experimental block is between the Saint Lawrence and the Leonard mines, two of the older producers in the Butte district. Reports are that the company plans mining ore of less than 1 percent cop-

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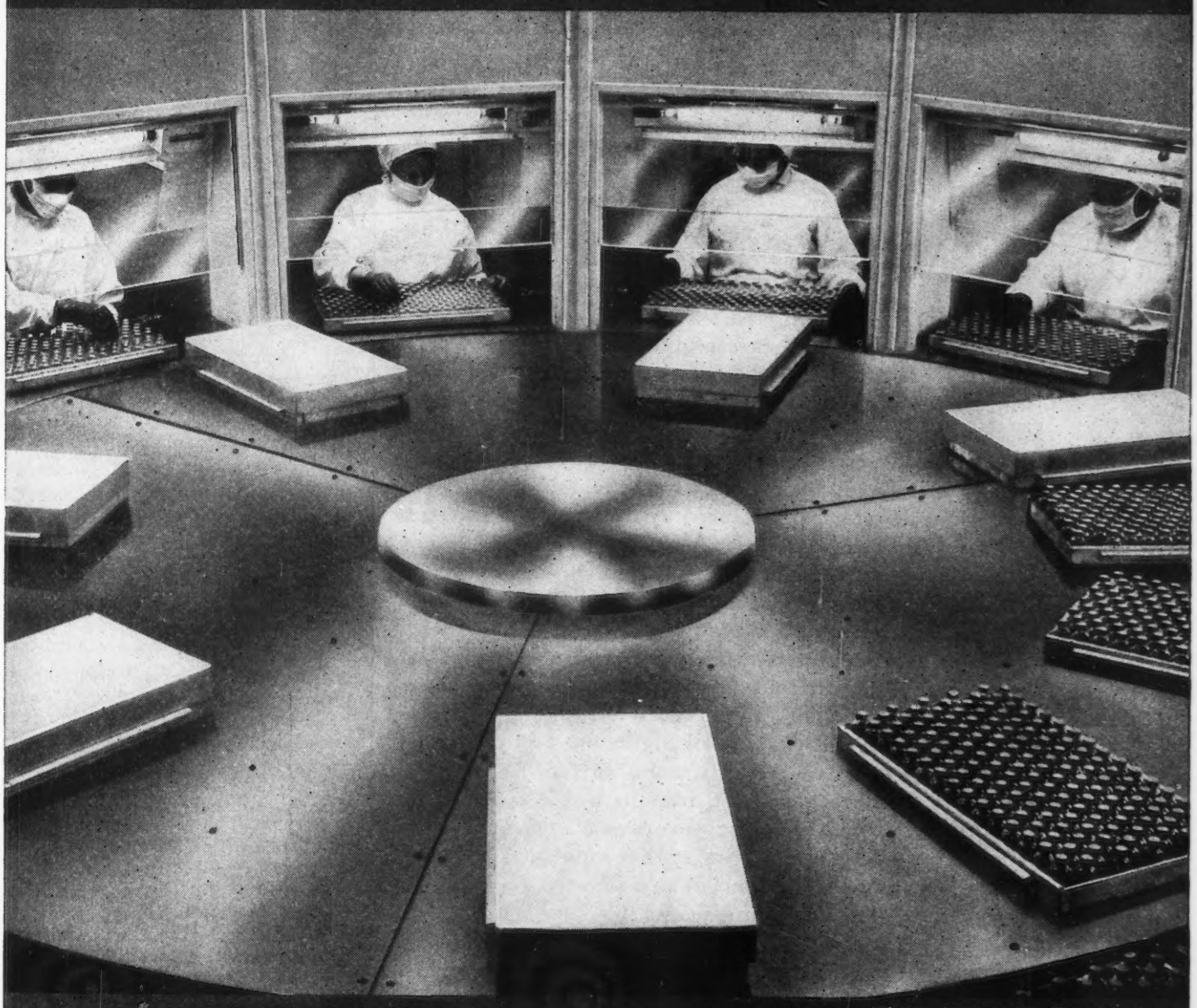

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Montana *(continued)*

per by this method. A new shaft will be sunk in East Butte for hoisting ore from the main haulage. The ore will be shipped to Anaconda and concentrated in the company's flotation mill.

★William Anderson, who has been acitve during the past few years in the development of Montana Phosphate Products Co. near Garrison, recently sold his interest in the company to Consolidated Mining & Smelting Company of Canada. Consolidated owns majority interest in the Montana property. The crude phosphate from the Montana mines is shipped to Trail, B. C., where it is concentrated and made into commercial fertilizer.

★Winston Bros., mining and construction company, with headquarters in Minneapolis, recently acquired the Golden Sunlight mine, near Whitehall. This property has been owned by A. O. Smith Corporation, of Milwaukee, for several years but has been operated under lease during the war by Reiboff and Fenner, both of Whitehall. Winston Bros. are conducting experimental work to develop a process of extracting the gold from the low-grade ores. The firm's Montana operations are managed by A. Strojan, of Helena.

★The United States Vanadium Corporation's chrome plant at Red Lodge has been dismantled and the equipment shipped to out-of-state properties operated by the company. The chrome properties in this area have not been active since 1943, when imports of foreign chromite were resumed.

★A two year program for the Montana Bureau of Mines and Geology has been announced by officials of the bureau. A brief summary of the program is as follows:

1. Continuation of district surveys and publication of reports dealing with the geology and mineral resources of mining areas not heretofore covered.
2. A study of certain sedimentary beds associated with mineral deposits to determine the structural and stratigraphic factors controlling the deposition and localization of orebodies.
3. Continuance, in cooperation with the U. S. Geological Survey, of surface and subsurface studies of Mississippian and Devonian beds in potential oil and gas producing areas.
4. A re-study of lode gold areas with respect to possible placer deposits which may have been derived from them but which were overlooked in earlier prospecting, together with a survey of the entire placer mining situation.
5. Field study and compilation of all available data on the non-metallic mineral resources of the State other than coal and petroleum.
6. Extension of further aid to operators of small mines by assigning members of the Bureau staff to

visit and advise on problems of development and mining, methods of ore treatment, markets for their products, and similar problems. Milling tests will be made when in the judgment of the examining engineer the quantity and quality of ore developed warrants the expenditure of the taxpayers' money for that purpose.

7. Continuation of aid to farmers in dry areas seeking advice as to possibility of obtaining water by drilling wells.

8. Completion of the geologic map of Montana, work on which has been under way for several years in cooperation with the U. S. Geological Survey.

9. Cooperation with other State agencies and federal surveys in compiling an accurate topographic base map of Montana by aerial surveys and otherwise.

★The mill at the Green Mountain mine, near Dickson, is being rebuilt after having been completely destroyed by fire last summer. The new 50-ton flotation mill will produce a bulk concentrate containing copper, gold, platinum, and silver. Concentrate produced by the old mill averaged about forty percent copper. The operators announce that they plan to sink the main shaft 100 ft. below the bottom level, and drift under known orebodies. Earl F. Elstone is in charge of the operation.

★A. V. Taylor, Jr., has resigned as mines geologist, U. S. Smelting, Refining & Mining Co., Salt Lake City, and Sanford R. Knapp has resigned his position as director of material supply for the British Air Commission, 15 Broad St., New York City, to devote their entire time to the Taylor-Knapp Co., which for several years has been interested in various mining operations in Montana.

The Taylor-Knapp Co. has recently purchased the entire holdings of the Moorlight Mining Co. at Philipsburg, Mont. The Moorlight Co. has for a number of years been the largest producers of battery manganese ores in the United States, and is under the direction of the late John Hickey.

IDAHO

Bunker Hill cadmium plant in operation—Sink-and-float plant to treat Sierra-Nevada dump material

★After five years of experimenting and research work, Harold E. Lee, research metallurgist for the Bunker Hill & Sullivan, announces that the company has constructed a special type of plant to recover cadmium metal from lead smelter fumes and that the plant is now in operation, producing about 50,000 lbs. of 99.96 percent pure cadmium per month.

Mr. Lee stated that "Economical

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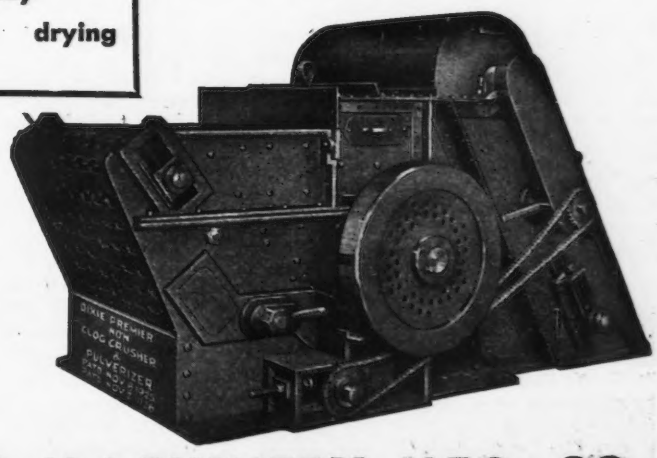

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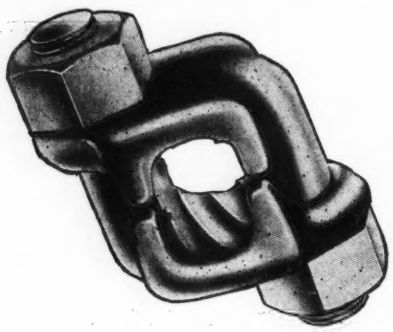
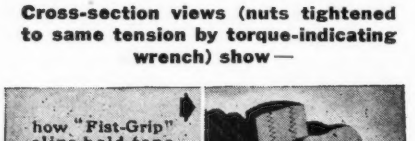


Cross-section views (nuts tightened to same tension by torque-indicating wrench) show—


how "Fist-Grip" clips hold rope closely to original shape.
how "finger-pinch" U-bolt squeezes upper hemp center, distorting, weakening rope.

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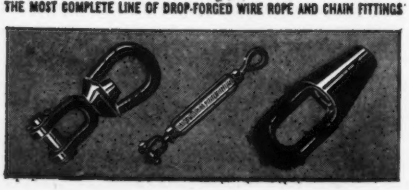

Idaho *(continued)*

cadmium recovery operation at the Bunker Hill smelter was dependent upon an improved method of converting the cadmium content of our baghouse product into a readily soluble form and to the attainment of higher cadmium concentrations. Both of these initial objectives were gained in the development of reverberatory concentration procedure."

★The Sunshine Consolidated Mining Co., through its president, W. M. Yeaman, of Yakima, Wash., announces that the company is ready to start production of high grade silver-copper-antimony ore as soon as mine labor is available. Sunshine Mining Co. recently bought a half interest in this property, and all production will be under the supervision of Sunshine.

★Vindicator Mining Co. has started underground mining operations on a high-grade mineral showing east of the Lucky Friday mine, at Mullan. The company has built new roads, installed a compressor plant, built new mine buildings, and otherwise equipped the property for a campaign of underground prospecting.

★Dan Murphy is shipping high-grade zinc-lead-silver ore from the Orofino mine, at Murray, to the Hercules mill, in Wallace. The ore is a reject product from a sorting-belt operation which produces high grade for direct shipment to the smelters. Murphy holds the Orofino property under a ten-year bond and lease. He had to drive a crosscut 800 ft. to reach a productive part of the vein.

★Lucky Friday Silver-Lead Mining Co. is down about 100 ft. in a new shaft development program destined for the mutual development of Lucky Friday, Hunter Creek, and Lucky Friday Extension properties, all of which are on the same vein system. The new shaft is three-compartment and starts on the 1,000-ft. level. The first objective is the 1,400-ft. level, from which point it will require 1,000 ft. of drifting on the Lucky Friday vein both east and west to reach the end lines of the two other properties. The company is installing underground a new 360-cu. ft. Chicago pneumatic air compressor, doing away with all installations on the outside.

★The Lynch-Pine Creek Mining Co. has leased from the Bunker Hill the old Sierra-Nevada mine dump, containing several hundred thousand tons of mineralized material that was too low grade to pay for treatment t the time of extraction by the old Last Chance Mining Co. The material will be hauled by truck to the Amy-Matchless mill, on Pine Creek, where the Lynch company is erecting a 300-ton sink-and-float treatment plant. The ore will first be screened to remove the fines and the product thus recovered will be put through the sink-and-float to remove the waste, after which both the sink-and-float product and the fines will be treated by flotation.

★The Snoose Mining Co., near Hailey, announces its intention to sink on a body of lead-silver ore which has produced the company $30,000 from ore shipments since prospect work was started early this year. The Snoose property is in a mineral belt between the Famous Minnie Moore mine and the North Star mine, both of which have record productions. A. M. Jensen, formerly mine manager for the Triumph company, is part owner and manager of the Snoose property.

★The San Francisco Chemical Co., a subsidiary of the Mountain Copper Co., of California, has started mining a phosphate deposit known as the Waterloo, near Montpelier. The company is building and equipping a 300-ton treatment plant at the mine. John Kobe, who has been quarry superintendent for the copper company for the past 18 years, will have charge of the mining operation.

★The Garfield Trust Mines Co. has been organized in Boise to develop the old Garfield and War Eagle mines, in the Muldoon district of Blaine County. The Garfield was a former producer of lead-silver ore but has been closed since 1939 because of litigation. The property is equipped with a 50-ton flotation plant.

★Bunker Hill & Sullivan announces its fourth quarterly dividend at 25c a share, or $327,000. This dividend includes the regular quarterly dividend of 12½c and an extra dividend of like amount, and brings the total paid this year by Bunker Hill to $817,500, against $654,000 last year, and brings the grand total paid to stockholders to date to $59,895,241.

During the past two years, the Bunker Hill management has been preparing to sink to the 4,000-ft. level, which would give 1,200 ft. additional depth below any productive area in the mine. With this end in view, the company has recently installed $550,000 worth of new shaft equipment. Additional expenditures for installation and other preliminary work are estimated at around $250,000. During the past year the company has also spent huge sums on improvements in its smelter and ore-dressing plants.

WASHINGTON

Copper deposit to be developed in St. Helens district—Large low-grade gold-silver property to be opened

★Northwest Mining Association, at its meeting in Spokane on Oct. 29, passed resolutions supporting the mining companies of the Coeur d'Alenes opposing the construction

of the dam at Springston, on the Coeur d'Alene River, which Army engineers are advocating to augment the water supply for Coulee dam. The resolutions passed call attention to the complex fault system of the terrain in the western part of the Coeur d'Alene mining district. They assert that the open veins near the surface, if the district is flooded, might cause unsurmountable water problems underground where pumping costs already are a major item of expense for existing mines, and that this expense might readily become so heavy as to make mining unprofitable for some of the companies operating in the district.

★H. D. Winger, representing Los Angeles interests, reports that development of Polar Star copper deposits in the St. Helens mining district, on Green River in western Washington, will soon be started. He says already nearly a million dollars has been expended on this development, which disclosed a great deposit of copper ore with high grade streaks of lead, gold, and silver values. The owners have 640 acres of ground.

★Rapid progress is being made by Big Lake Mining Co. in putting the old Cuba mine, southwest of Kettle Falls, into operation. Old buildings have been repaired and reroofed, and two new buildings erected as bunk house and shop, and storage is being provided, according to Will Everett, president. The compressor has been overhauled, and a temporary gas power unit put in to use until electric power is available. Ores are now accessible on two veins which are parallel 125 ft. apart. On one 6-ft. face the ore yields 4 percent lead, and 6/10ths percent zinc, $2.80 in silver, and $5 in gold. The second yields 6 and 9/10ths percent lead, 2 and 7/10ths percent zinc, and 5 to 11 oz. in silver across 4 ft. The latter vein shows a width of 20 ft. on the surface and 8 ft. in a tunnel on the 200-ft. level.

★Keegan Mining & Development Co. plans to enlarge its silicous low-grade gold and silver deposit in Chelan County, which is being worked by Angelo American Co. Three million tons have been blocked out of a total 20,000,000 tons. A 500-ton mill is under consideration. Values range from $2 to $5 in gold, with substantial showings in silver. Compressor and other equipment are on the ground. A network of small veins has been opened by diamond drilling. Arthur Hall, mining engineer, is superintendent.

★Hopkins & O'Brien, of Spokane, and Pend Oreille Mines & Metals Co. have reached a settlement of the ownership of about a dozen claims in the Metaline district, in townships 39 and 40, range 43 east. Judge Brown has given to the first-named parties four claims, and the others to the Pend Oreille company.

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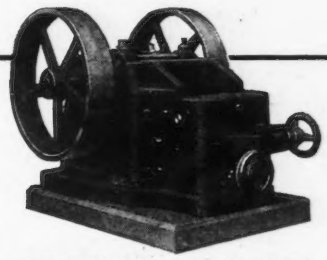

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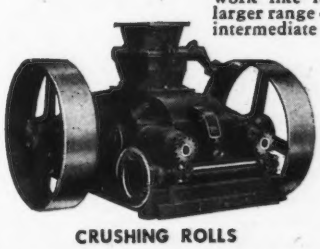

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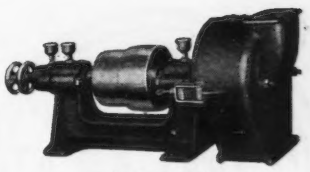

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CALIFORNIA

Dredging companies contest top-soil replacement ordinances—Dragline dredge operations increase

★Ordinances of county boards of supervisors requiring top soil to be restored to gold dredging areas are being contested by dredging interests on the ground of unconstitutionality. Recently, the Stanislaus County supervisors repealed its ordinance, and its district attorney is collaborating with district attorneys of Merced, El Dorado, and Amador counties in preparation of a new ordinance. Dredge operators are preparing to fight the enforcement of such ordinances on the grounds that it would be physically impossible to comply with the provisions.

★With one large dragline dredge unit already in operation at Mormon Bar, Placer County, the Golden Feather Dredging Co. is planning to install a second dredge by Jan. 1, 1946. The company recently acquired extensive gold placer holdings on the Middle Fork of the American River six miles from Auburn, and the dredge now active has a capacity of 7,000 cu. yd. a day. E. A. Wiltsee is president of the company, with S. J. Norriss, Jr., manager, in charge of operations.

★Summar Dredging Co. has installed a dragline dredge on the Kelley-Dogtown gold placers in the Willow Spring area of Mono County, following comprehensive test work which disclosed a substantial yardage of pay gravel.

★V. A. Gray and William George are preparing to rework the last portion of tailings impounded at the King Solomon mine, near Cecilville, Siskiyou County, formerly worked on an extensive scale by the late Roy Bishop, of San Francisco. Mined ore was milled in a 300-ton plant, the resultant tailings being held in the bottom of the gulch below the mill by log dams.

★The Ruth Pierce mine, in the Hornitos district of Mariposa County, is being reopened by Thomas Thomson and associates. The mine has been active at different times, the last work being done in 1926 by James McMahan, superintendent. For the past several years Serafin Correa and partners have been recovering gold values from mill tailings in a small cyanide plant. Mr. Thomson and associates have erected a 40-ft. headframe, and are now installing a hoist, compressor, and power-generating equipment. Mined ore is to be milled at the Domingues mine.

★Sierra Metals, controlled by Stewart and Nuss, Fresno contractors, and H. E. Bush, mining engineer, is currently handling some 200 tons of gold ore at the Mountain King mill, following shutdown of the copper operations by Keystone Copper Corporation and purchase of all milling equipment contained. Capacity of the mill while treating copper ore from the Keystone mine, at Copperopolis, Calaveras County, was 600 tons a day, but on gold ore the capacity is near 1,000 tons. It is the plan to aim toward full capacity, with the bulk of the ore to come from the Mountain King mine, and the remainder from nearby properties. H. E. Bush, with headquarters at Angels Camp, Calaveras County, is engineer for the company.

ARKANSAS

Lead-zinc properties leased from States—Manganese production increases in October

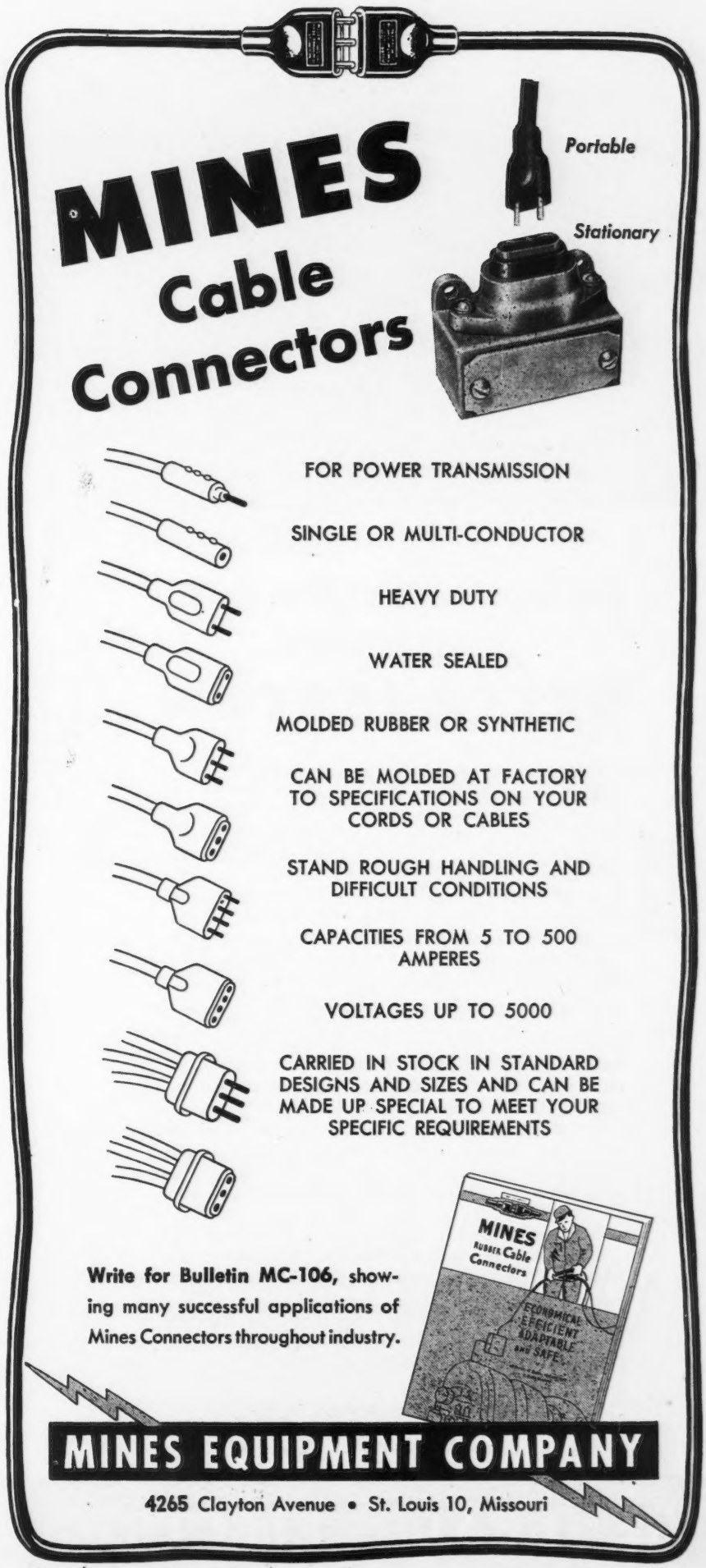
★The Diamond Corporation of America has obtained a charter to engage in mining diamonds in Arkansas. Incorporators are H. G. Yost, K. R. Gregory, and C. G. Dederick, of Chicago. Amount of capital was listed at $300, the minimum required. Capital stock authorized was 4,000 shares without par value. John W. Newman, Little Rock attorney, was named resident agent. The application did not state whether the company owned property in Pike County, site of former diamond mine operations.

★H. Steadman Williams, of North Little Rock, has leased 200 acres of State lands in Searcy and Marion counties to develop lead and zinc properties. It is reported that mining operations will commence immediately. The State will derive rental of $5 a month for each 40 acres and a one-eighth royalty from gross receipts from sales of the minerals.

★Albert Hess, of Little Rock, reports the discovery of a large barite deposit in the barite district of south Montgomery County. Claims have been filed on the deposit in the name of the Milwhite Co. of Houston, Tex.

★S. & G., Inc., operating the Hurricane mine, in Searcy County, near Pindall, Ark., produced 150 tons of high-grade zinc carbonate in October. Current operations are in the brecciated formation, which carries high grade carbonate. Former operations were in residual clay, which also carried high grade carbonate.

★The Arkansas Mining & Refining Trust Co., operating the North Star mine, near Harrison, Ark., has suspended operations temporarily. W. S. King, geologist, of Harrison, inspected the property recently and discovered one cross-fissure vein,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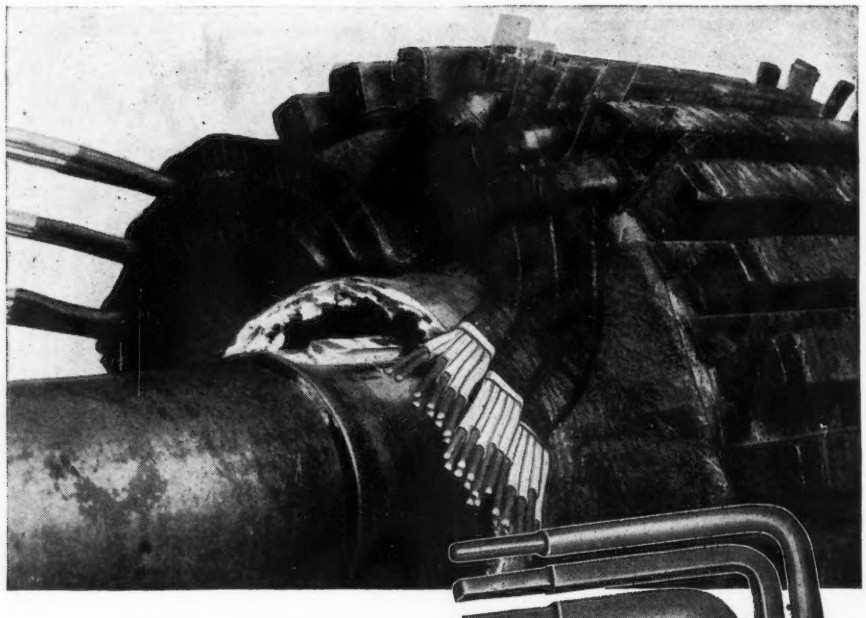

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Arkansas *(continued)*

which had been bypassed and carried 45 percent metallic zinc and a slight trace of gold and silver.

★Because of better labor conditions, clear weather, and new equipment, operators in the Batesville-Cushman manganese field produced 396 tons more ore in October than in September. Total production in October ran to 1,475 tons, of which 817 tons was high grade and 658, low grade. R. P. Potashick & Co., conducting pit mining on the Southern Hill, produced 600 tons of high-grade that ran around 0.51 percent Mn. The Arkansas Manganese Co., operating the Aydelotte property, near Cushman, produced 515 tons, of which 107 tons were high-grade and 408 tons low-grade. The Walter H. Denison Manganese Co. produced a total of 345 tons, of which 95 tons was high-grade and 250 tons low-grade. Most of the company's production came from the properties in the Peffeifer district. One new shaft sunk in October is now in production on the Ozark property.

TRI-STATE

USBM directs survey of ore reserves in Picher area, and resumes exploratory drilling

★A survey of ore reserves in the famous Picher area of the Tri-State zinc-lead mining field has been inaugurated under the direction of the U. S. Bureau of Mines, with Otto Ruhl, of Joplin, Bureau engineer, in charge of the project. With completion of the Picher survey, it is planned to extend the work to comprise the entire district. Different drainage subdivisions of the district will form the basis of the surveys. Ruhl will be assisted by Clinton C. Knox, L. W. Brichta, O. Bishop, and A. Holt, engineers connected with the Joplin operations office of the Bureau.

★Floyd Craig and associates are sinking a new shaft on the Fillmore land, a half mile south of Fillmore's bridge over Shoal Creek and just west of the old Burton mill, on the Renzenhauser land. The shaft will be sunk to a depth of 150 ft., where drilling several months ago showed a good face of zinc ore. A sinking derrick has been built and other accessory equipment has been installed at the mine.

★Exploratory work of the U. S. Bureau of Mines in the Tri-State mining field, which had been discontinued under a reduced appropriations budget, has been resumed, according to Otto Ruhl, project engineer in the Joplin operations office of the Bureau. Drilling operations on three projects was affected, those on the Winchester land in Newton County south of Joplin; on the Wayland land, a mile and one-half southwest of Galena; and in

the Melrose district, west of Picher along the Kansas-Oklahoma state line. One rig was used on each of the three projects at first and the number will be subsequently increased to about six, Ruhl said.

★C. G. & C. Co. has taken a lease on the mill of the Northside Mining Co. a short distance southwest of the Chitwood tailing plant of the Missouri Mining Co. The mill, which has a capacity of 25 tons an hour, is owned by George W. Moore, C. C. Madison, and Jack Ferneau. The C. G. & C. Co. which operates the old Skelton mill south of Picher as a tailing plant, is developing a new mine site on the Potter ranch, a half-mile west of the Oak Hill Golf and Country Club, west of Joplin.

★F. W. (Mike) Evans, who has been operating a Sauerman slack-line cableway and a Sauerman scraper drag at the Sucker Flat open-pit mine in the south-central part of Webb City, has started milling operations, utilizing the washing and re-treatment plant built by the Cooley brothers a few years ago. Ore will be treated over the old Cooley plant at the rate of 75 or 80 tons an hour, according to Carl Carmean, superintendent.

★The mine mill of the Lula Bell Mining Co. at Hockerville was destroyed by fire Oct. 14 at an estimated loss of $75,000. The company is temporarily milling ore from its Liza Jane lease, west of Baxter Springs, over the No. 1 mill of the Beck Mining Co., east of Picher.

★Eagle-Picher Mining and Smelting Co. suspended milling operations at the American mill, in Oronogo, effective Nov. 1, according to H. W. Harrison, Tri-State manager of mines and mills for the company. Ore produced from the famous Oronogo open-pit mine by the Oronogo Mutual Mining Co., formerly treated over the American mill, now will be shipped by rail to the Eagle-Picher Central mill near Cardin, Mr. Harrison said. He also reported that the company's new shaft on the Foley lease, north of Picher, in Kansas, was now down to a depth of 350 ft., and that water was encountered at the 310-ft. level. The shaft will be sunk to a depth of 450 ft., to tap a deeper run of ore previously disclosed by prospect drilling in the area by the company.

★Mining and milling operations of the Bilharz Mining Co. on the Brewster land, a mile northwest of Baxter Springs, were suspended Nov. 1, according to O. W. Bilharz. Expiration of the lease on the 160-acre mining tract and depletion of the orebody as far as development work had been carried were given as the reasons for closing the properties, which had been operated by Mr. Bilharz over a ten-year period. Although the Bilharz-Brewster properties have been closed, Mr. Bilharz plans to move the mill, with the possibility of rebuilding it on another lease.

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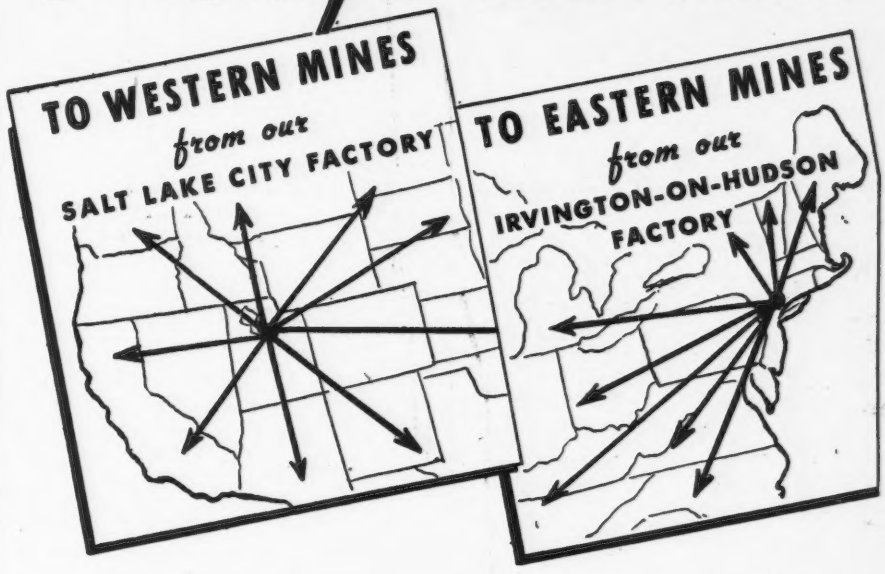

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IRON COUNTRY

Labor dispute settled — Mather mine completes drainage of 1,750-ft. level

★Iron-ore shipments over lake routes from the Lake Superior region totaled 9,826,622 gross tons for October 1945, according to a report by the Lake Superior Iron Ore Association. September shipments were 10,543,099 gross tons.

Season shipments to Nov. 1, 1945, including those from Michipicoten and Port Arthur, totaled 71,498,393 gross tons. Total shipments for the same period in 1944 were 76,498,172 gross tons.

★After a rehearing in Crystal Falls, Mich., on Nov. 6, Judge Bell awarded $5,786.12 to Mr. and Mrs. David H. Campbell, Iron Mountain, Mich., for their one-twenty-fourth interest in the profit on ore removed and shipped from the Minckler mine, in Iron County, by the Hanna Ore Co., from Nov. 22, 1941, to May 22, 1945. Tonnage involved totaled 266,261. The case has had several hearings and was once appealed to the State Supreme Court.

★After a walkout of all miners at the Buck and James mines of Pickands, Mather & Co. on the Menominee Range, a full settlement was made at a conference between management and union representatives and the miners were back to work by Nov. 3. The company agreed to provide transportation for surface workers from the Buck to the James mine and also to pay the men for the time spent in traveling from mine to mine.

★A large meeting of CIO union delegates met at Iron River, Mich., on Nov. 3, from the Gogebic, Marquette, and Menominee ranges, to discuss the U. S. Steel Co. refusal to grant a $2 per day increase for United Steel workers. The meeting was called so that should a strike develop later it will have official recognition.

★At the Mather mine, near Ishpeming, Mich., an ore vein mixed with water was tapped on the 1,750-ft. level over a year ago and showed a pressure of 700 lb. p.s.i. in the drill hole. This vein, leading into an old iron mine 1,000 ft. north of the Mather shaft that had not operated for 50 years, was 1,000 ft. deep and called the "Hematite" shaft. To be able to operate on this vein required draining the old mine. A drift was driven through the rock on the 1,000-ft. level, two 500-g.p.m. centrifugal pumps were installed, a steel bulkhead door 5-ft. square able to withstand a pressure of 400 lb. p.s.i. was concreted in for protection if needed, and the water in the old mine was tapped with a 4-in. diamond drill hole. The pumps started operating Sept. 26 with 175 lb. p.s.i. on the suctions. By Oct. 26 the drainage of the old mine was completed. It is now safe to start mining ore on the 1,750-ft. level.

★The Marquette Range Engineers' Club, at its November meeting, elected the following officers for the coming year: Joe C. Cameron, president; Clyde T. DeHaas, vice president; Peter P. Ribotto, secretary; Frank D. Masek, treasurer; and L. C. Moore, C. W. Nicholson, and A. Syverson, directors.

MICHIGAN

Peninsula Copper authorized to accept Calumet & Hecla offer—Quincy mine conducts diamond-drill exploration

★At a special meeting of the stockholders of the Peninsula Copper Co. in Houghton on Nov. 16, the board of directors was authorized to accept the offer of the Calumet & Hecla Consolidated Copper Co. to pay $250,000 in cash, surrender 8,114½ shares of Peninsula stock, and to waive any rights as a holder of Peninsula stock acquired by it in exchange for Seneca bonds to participate in any distribution of the proceeds from the sale. The stockholders also authorized the termination of the existence of the corporation and the liquidation and distribution of its assets pro rata among its stockholders.

Acceptance of the offer of Calumet & Hecla means that the Peninsula company will have received in full payment of its property (the old Seneca), $709,109.44. After payment of the cash purchase price of the property, corporate expense, the first liquidating dividend of $1.00 per share, and the second liquidating dividend of $1 per share which was paid on Oct. 25, there will remain in the treasury the sum of $410,499.27. This will permit further liquidating dividends of approximately $10 per share after paying the expenses of liquidating the company.

★The Isle Royale Copper Co. has declared a dividend of 30c per share, payable Dec. 8 to stockholders of record Nov. 5, 1945. The last dividend was paid on July 25, 1944, and was 50c per share. The contract of the Isle Royale company with the Metals Reserve Co. expired on Aug. 31, and the company is now operating under the Premium Price Plan with a substantially lower price for its copper. During the past two months the underground force has been increased materially, and this fact, together with

a curtailment of development work and a careful selection of rock underground, has made possible the continuation of operations for the time being.

★The Premium Price Plan expires June 30, 1946, by law, unless terminated sooner, and there is little likelihood of a further extension of the Act. At the Isle Royale mine, and other mines in the Michigan district, there are millions of pounds of copper accessible in ore already developed which should be recovered while all plant facilities are still in place. If these mines are forced to close and allowed to fill with water, and the surface plants scrapped, the copper in the mines now accessible will be permanently lost.

In the interest of the national well-being, it is contended some plan should be worked out before the expiration of the Premium Price Plan to permit the recovery of this irreplaceable natural resource and to help stabilize the labor situation in the district, two objectives of special value.

★Early in the season, Calumet & Hecla was notified that it would not be permitted to purchase all of the coal ordered for the winter season. Enough coal was promised, however, to take care of needs until May 1, 1946. But the coal strike stopped all shipments to Lake Superior ports, and this leaves Calumet & Heclar some 30,000 tons short of the amount needed before the opening of navigation next spring. Under the circumstances, some curtailment of operations will be necessary. To keep curtailment at the minimum, the utmost economy in the use of steam and electric power in all departments will be imperative.

★The Copper Range Co. whose Champion mine, at Painesdale, is closed temporarily, has started the sinking of a new shaft on its White Pine property, in Ontonagon County. Some of the men from Painesdale are engaged in the work. White Pine is approximately 60 miles southwest of the Champion mine. The copper occurs in two sandstone beds and parting shale underlying the Nonesuch shale. Tests conducted over a period of several years have resulted in a suitable mining method and milling practice for the treatment of the White Pine ores.

★Although the Quincy mine is closed, good results are being obtained in the operation of the reclamation plant at Mason. It is estimated that about one-third of the cost of the plant, which was built on Government loan, has already been paid. Quincy also is conducting diamond-drilling operations on the Pewabic series of lodes in the north end of its property. This work is of an exploratory character. It may mean that some time in the future a new shaft or shafts will be sunk.

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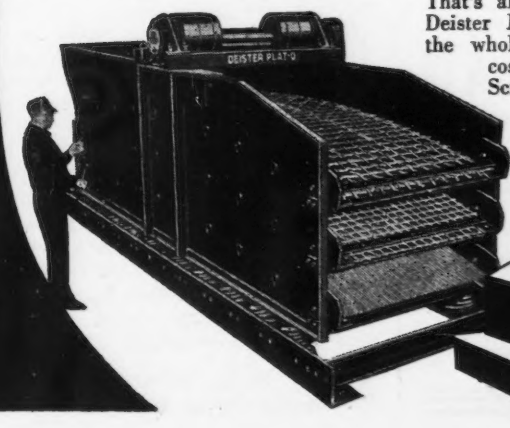

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ALASKA

Many gold properties plan to renew activities next spring—Scouting parties search for opportunities

★Ralph J. Lomen, who has been flying over the Nome district, reports that though mining activities have declined, it is believed they will make a decided headway next year, and will approach a prewar status. New dredges, he says, will be operated by the U. S. Smelting, Refining & Mining Co., but what is most needed is a revival of prospecting. "Without this we cannot expect a return to heavy gold production," he says. "Only a few men are going into the hills, and the Territory or federal government should do something to encourage prospecting. If a tax exemption of three years on initial production were enacted, I believe much capital would be provided to finance prospectors of experience." Mr. Lomen is head of the Lomen Commercial Co.

★Carl Whitman, president and general manager of Nabesna Mining Corporation, says that company expects to resume year-around operation in the spring. He has spent the season at the Nabesna gold quartz mine and elsewhere in Alaska. Repair work will be initiated in the early spring at the Nabesna, and he expects large scale operations will be under way by the middle of next summer. Production will eventually be brought up to 100 tons of ore a day, compared to a former 60-ton limit. Before the shut-down 50 men were employed. During the season Whitham located a silver-lead property on Indian River in which Bob Reeve and Keith Capper also have an interest.

★The Anchorage Chamber of Commerce is proposing a mining congress in that city next spring. H. A. Faroe, chairman of the Chamber's mining committee, and Harold Strandberg are advocating plans for the congress.

Mining men in the Anchorage, Fairbanks, and Seward regions are looking forward to a general revival of activities next spring, according to Sam W. Taggart, of the Palmer G. Lewis Co., who has made a two weeks' visit into these districts. "Fairbanks mining men and those in other districts are preparing to resume gold placer operations in the spring, and the Territory should have a substantial gold yield next year," he said. The dredge of Olson and associates, in the Nome area, was operated by a new concern last season under direction of Joe Lucas. The rush into the Kenai Pen. by men seeking land and mining opportunities was pronounced."

★E. N. Patty, general manager of the McRae-Patty placer operations, who has concluded another airplane trip into Alaska and the Yukon, states that mining men from the States and Canada have been scouting for new opportunities in the North, and hope to be engaged in gold mining next season. Some of these men are already assembling equipment. The McRae-Patty interests have taken over a large tract of placer ground on Thistle Creek, a tributary of the Yukon, and expect to install a dredge, which they hope to have in operation by the spring of 1947. This concern, which operated a gold dredge on Coal Creek, above Circle, on the Yukon, closed down for the winter Oct. 17, and closed its dredge operations on Clear Creek, a tributary of the Stewart River, Oct. 20.

★Besides a short period of mining this season, Wolf Creek Mining Co. did considerable work in stripping and preparing ground for work next season at its property near Fairbanks, according to Mannie Olson, a member of the company.

★Seven miles of road is under construction from Hollis to the Lucky Nell gold mine, according to Leonard Smith, Territorial Highway Commissioner. The road is from mine to tidewater. The Territory will expend about $3500 on the enterprise.

★Camp Creek Mining Co. has sent in a cargo of mine equipment to its property west of Nulato, on the Yukon River. The equipment includes hydraulic pipe, sluice boxes, tractors, lumber, diesel oil, and camp supplies purchased from Axel Palmgren. The company is a partnership composed of G. A. Gustafson, Trury Anderson, and Don Hammond, of Fairbanks.

★A cleanup of $30,000 was made in 1945 at the Marvel Creek placer property, in the Bethel district, according to Orville Toach, a pilot who has returned to Anchorage. He says 12 men were employed during the season. He reports that at the Willow Creek mine, at Marshall, production is expected to start this year. George Marsh is in charge.

★In the Willow Creek district, which lies about 75 miles from Anchorage, the Gold Chord mine has five men doing development work under the supervision of A. L. Renshaw. The Fern mine has been reopened by Walter Grohnert, of Anchorage, and five men are engaged in development under the supervision of Al Dodson. Chris Paulson and Associates, operating in the Snow Bird Mining Co., are opening a new property on upper Reed Creek. At present they are installing a 6000-ft. tramway and camp facilities. When this property starts production, it will be the first operating property on Reed Creek, which lies just north of the producing limits of the district. At the Milo Kelly property, underground and surface development was accomplished, and some ore was milled in the company's

8-ton mill this summer, under the supervision of Lee Dolan. The Independence mine is shut down for the winter due to labor trouble.

★The placer ground formerly worked by the Kaiyuh Mining Co. on Camp Creek, in the Kaiyuh Hills, lower Yukon district, has been taken over by G. A. Gustafson, Tury Anderson, and Don Hammond, of Fairbanks. Equipment for next year's operations was sent down the Yukon before the freeze-up. Some prospecting done by the new operators this summer showed values of 50c to the square foot of bedrock.

★Ben Dahl, operating a placer mining ground 7 miles from Rampart, on Hunter Creek, employs a crew of three or four men. A B-63 tractor and bulldozer have been ordered and will be used in next summer's operations. Emil and Albert Swanson also have an outfit on Hunter Creek.

★Mr. and Mrs. Bruce I. Thomas recently entertained citizens of Fairbanks at a reception given aboard the U. S. Bureau of Mines Safety Car, which had been brought from Anchorage for display and to present a course in mine safety and rescue work for mining. More recently Mr. Bruce has given up his position with the Bureau to accept a position with Livengood Placers.

CANADA

Nine government-owned plants sold to private industry—High attendance marks British Columbia meeting of C.I.M.

★War Assets Corporation, to the end of October, had sold nine government-owned plants to private industry for a total of $5,148,000. Within a short time, these facilities are to be engaged in civilian production. Nichols Chemical Co. purchased the sulphuric acid plant at Valleyfield, Que. Anaconda Copper and Brass Co. acquired the plant of Canadian Strip Mill, Ltd., New Toronto, Ont. Dominion Magnesium, Ltd., purchased the plant at Haley's Corner, Ont.

★The large plant of the atomic project at Chalk River, near Pembroke, Ont., was destined to take on the atmosphere of a laboratory where scientists could be trained in the field of atomic research, according to a report at Ottawa by Dr. B. W. Sargent, acting head of the nuclear physics division, National Research Council. Scientists of the world, he said, had practiced internationalism better than any other group.

ONTARIO

★Timmins Mine and Mill Workers Union (CIO), Local 241, on Nov. 6 signed a collective bargaining agree-

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Canada (*Continued*)

ment with Hollinger Consolidated Gold Mines. A similar agreement was signed on the same day by the management of Buffalo Ankerite Gold Mines, Ltd., making the eighth Porcupine mine to enter into collective bargaining. At three other mines in that camp negotiations are still in progress. Employees at only one mine, the Dome, have rejected the union as bargaining agent.

★A large deposit of magnetite iron ore, at the Goulais property of Algoma Steel Corporation, is being studied to determine methods of treatment. After the process has been perfected, it is the intention of Algoma Steel to undertake production, provided market conditions are favorable. The deposit is within 50 miles of the steel plant at Sault Ste. Marie.

★Nickel production at Sudbury, the world's major source, was reduced, early in November. Operations were further cut back by the closing of a reverberatory furnace at the Copper Cliff smelter and a blast furnace at Conniston. Nickel which had been held in reserve for war materials was being liquidated, in competition with new metal. Restrictions on the use and distribution of nickel mill products were removed on Aug. 24, by Munitions Minister Howe. Stocks had reached an all time high, early in November, at the Port Colborne plant. The unsettled conditions in the reconversion period were assumed to be the cause of the sharply lower demand for nickel. Canadian metal was expected to have important possibilities in international trade after all restrictions have been withdrawn.

★Queenstown Gold Mines announced the start early in 1946 of pre-production development. The two-compartment shaft is down to 250 ft. The Larder Lake fault zone is to be explored by underground work, based on drilling results along the carbonate zone. Intersections include $16.28 across 28 ft., $6.50 across 66 ft., and $4.94 across 143 ft. Outside the main zone, a parallel structure to the southwest occurs under similar conditions and indicates substantial volume of commercial grade. The shaft is to be deepened and the property equipped for production. This property, the former Murphy mine, adjoins Upper Canada. R. R. Brown is president.

★C. D. Salkeld, resident engineer, Crowshore Patricia Gold Mines, reports shaft sinking has been started with a depth of 1,000 ft. as the objective. The property adjoins the Albany River mine, which is controlled by Pickle Crow Gold Mines. Five vein systems are to be explored from this shaft, following information secured by diamond-drill holes.

QUEBEC

★Workers employed by Asbestos Corporation, Ltd., at Thetford Mines, and by Canadian Johns-Manville Co., Ltd., at Asbestos, have made application to the War Labor Board for wage increases and vacations with pay. The men were represented by their union, Federation Nationale Catholique des Employee de l'Amiante. In view of the wage increase granted in April, no additional grant was allowed. The case was left open for further consideration in certain matters, including the company system of converting points into money or wage rates. A job-evaluation method formerly recommended by the Board is being used by the asbestos companies.

★The monthly report of the Department of Mines on mineral production showed increased production of asbestos, cement, and clay products. For the first eight months of the year, asbestos gained 18 percent over the 1944 production. Gold output dropped to the lowest level for any month in August since February, 1936. The total for the first eight months was 455,832 oz. from Quebec mines, compared with 512,547 oz. a year ago. Silver was 4 percent higher in the eight-month period.

★Wartime Metals Corporation operated the Quebec property of Molybdenite Corporation of Canada, La Motte and La Corne townships, until July 15. During the life of the agreement, 2,759,324 lb. of concentrates were recovered from 208,954 tons of 0.7 percent ore. Molybdenum was produced to a total of 1,445,275 lb., for which payment of 10c a pound was made to Molybdenite Corporation. The owner is now proceeding with a development program to build up ore reserves. The flowsheet has been modified to make possible the recovery of bismuth, which is to be sold, in addition to the molybdenum, in European markets.

★Lake Dufault Mines, adjoining Waite Amulet Mines on the east, are operating two diamond drills for additional exploratory work preliminary to shaft sinking. From a set-up on the 1,050-ft. level, east of workings on the Amulet-Dufault property, copper values were secured in a 9-ft. core intersection. The south part of the property is being tested by drill holes put down from surface. W. B. Maxwell is president.

★Norseman Mines, holding three claim groups in the Yellowknife district, have been concentrating work on the property that adjoins East Sullivan, in Bourlamaque. Two shear zones have been explored, assays indicating gold values up to $5.20 a ton. Work is being guided by information secured from a geophysical survey. T. Koulomzine is consulting engineer; J. J. Coghlan, vice president.

★Dr. Harry Laird is directing work on the large group of claims held by Simon Lake Mines, Vauquelin Township. Two diamond drills are putting down holes to cross-section the property. A shear that shows width locally

exceeding 50 ft. has been traced for a length of 1,750 ft. Erratic gold values have been found, leading to a plan for shaft sinking and underground exploration. It is proposed to erect a small mill for use in bulk-sampling the deposit.

★Anglo-Rouyn Mines, controlling the property that was formerly held by Pontiac Rouyn, adjoining Powell Rouyn on the north, is making good progress with shaft sinking. A depth of 275 ft. was reached in October. A level is being opened at that horizon, and a second level is projected at 550 ft., the objective of the sinking contract. Farther to the west, an old shaft reached a depth of 275 ft. Diamond drilling, now in progress, is testing indications of copper-gold ore in a section of the claims about 3,900 ft. from the boundary of Joliet-Quebec Mines, the latter adjoining Quemont on the west. Charles L. Hershman is consulting engineer.

★T. G. Woodcock, in charge of work at Astoria Quebec Mines—four miles south of Rouyn—reports drifting is in progress on the bottom 400-ft. level. The objective of this work is to explore the D ore zone, for which diamond drilling indicated a length of 500 ft. Drill holes were put down to a total of 41,000 ft., in 1943-1944. A series of four zones was reported from that work. The management has announced the present program to be for the purpose of developing a large tonnage of low-grade ore indicated by the previous work. R. C. Gamble is president.

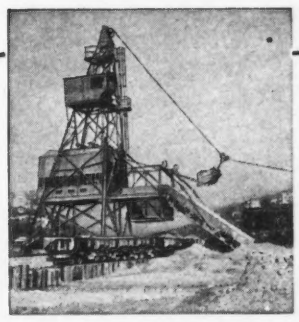
MANITOBA

★Hudson Bay Mining & Smelting Co., Ltd., during the three months ending Sept. 30, reports an increase in both tonnage milled and net earnings. Profit for the period was equal to 62c. per share, compared with 41c. and 51c. in the second and first quarters respectively. Estimated net earnings for the first nine months are $4,253,156 after allowance for taxes and write-offs.

★The Gold Hill Syndicate property, comprising some 24 claims near Cranberry Portage, has been optioned to Brewis and White, Toronto. A program of diamond drilling is proposed. This property was formerly operated as the Bergold Development Co., Ltd.

★San Antonio Gold Mines, Ltd., plans to acquire 250,000 shares of the adjoining Forty Four Mines. Previous entries into the Forty Four property on the 600 and 1,200-ft. levels gave negative results. It is now planned to work at a deeper horizon.

★Recent improvement in the labor situation at San Antonio indicates that a normal working crew may be available by the end of the year. The additional men will permit the resumption of long-delayed development work. An internal shaft from the 16th level is planned. For the first 40 weeks of the current year 106,297



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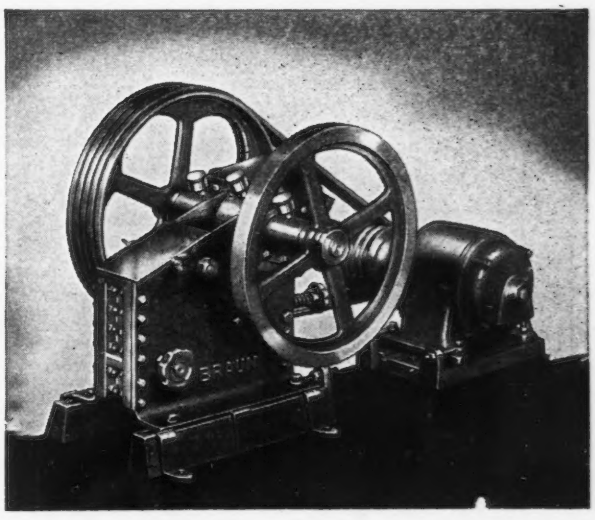

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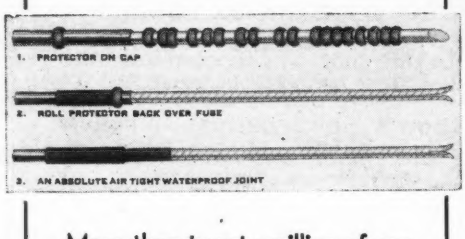

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Left to right: Dr. Charles Camsell, Deputy Minister of Mines and Resources, Ottawa; A. D. MacGillivray, chairman, B.C. Division, C.I.M.; George E. Cole, Director of Mines, Manitoba; D. A. Somerville, chairman North Pacific Section, A.I.M.E., at the annual meeting of the British Columbia Division, C.I.M., which was held in Vancouver on Oct. 24 and 25.

Canada *(continued)*

tons of ore were milled, with an average grade of $10.56 per ton. Operating costs for this period in 1945 were $5.43 per ton, and the operating profit was $545,045, exclusive of income tax and depreciation.

★Two Hearts Exploration, Itd., has been formed to acquire 99 claims in the Island Lake district. San Antonio Gold Mines, Ltd., owns 90 percent of a 100,000-share company. The name Two Hearts commemorates an Indian associated with the initial discovery of gold in San Antonio ground. A contract for 5,000 ft. of diamond drilling has been let.

★A new gold discovery is reported to have been made near the Manitoba-Ontario boundary at Little Stull Lake, in northern Manitoba. Ken Bay Mines, Ltd., has been formed to develop the property, comprising 36 claims. Hollinger Consolidated and Coniagas hold interests in the vendor syndicate. Arrangements for the shipment of drills to the property have been completed.

★The agreement by which Hollinger Consolidated Gold Mines, Ltd., will take over the Snow Lake Gold Mines, Ltd., group of claims adjoining Howe Sound on the east entails the purchase for cash of 50,000 Snow Lake shares and the expenditure of $25,000 on exploration prior to the organization of a 4½-million-share company. Snow Lake Mines will receive 1½ million shares, of which 365,000 are optioned back to Hollinger. Snow Lake Gold Mines retains 89 claims to the northwest of the Nor-Acme group and will continue development of this location independently.

★Tartan Lake Gold Mines, Ltd., has been organized to take over the ground formerly held by Brunne and Copper Lake Telluride Mines, Ltd., eight miles from Flin Flon. A diamond-drilling program which has been in progress for several months is nearing completion.

★Callinan Flin Flon Mines, Ltd., has completed a geomagnetic survey on its property immediately north of Flin Flon and plans a new diamond-drilling program in the light of the anomalies obtained.

★Sherritt Gordon Mines, Ltd., were recently awarded the John T. Ryan Regional Safety Trophy for the best accident record in the province. A feature of the occasion was the presentation of gold watches to 30 men who had completed five years' accident-free service.

★Results of the development program on the Wolverton Lake Gold Mines, Ltd., property some six miles northeast of Snow Lake have been released by A. J. McLaren, mining engineer. A total 5,051 ft. of drilling in 27 holes was recorded, and 52 surface samples were cut. Some values were intersected in the drilling over narrow widths, but in only one hole were the grade and width commercial. Surface sampling on the No. 2 vein throughout 4,500 ft. disclosed an average width of 1.9 ft. Highest value was 0.22 oz. per ton over 2.1 feet. Further development work is recommended.

BRITISH COLUMBIA

★The 24th annual meeting of the B. C. Section (formerly the B. C. Division), C.I.M., in Vancouver, Oct. 24-26, was an eminently successful affair. The registration of 373 was the highest yet recorded for a B. C. meeting. Five technical sessions, including one each on metal technology, metallurgy, geology, mining methods, and prospecting, were held. The metallurgy session was followed by a

symposium on the fine grinding of ores. The metal technology session was held jointly with the British Columbia Chapter, American Society for Metals, and was featured by an address on "Atomic Energy" by G. M. Volkoff, member of the Montreal laboratories staff of the National Research Council. Papers attracting particular attention were "Blast-hole Diamond Drilling at the Sullivan Mine" and "Geology and Development of the No. 8 Orebodies at Brittania." An address of particular note, "The Role of the Engineer in Rehabilitation and Reconversion," was delivered by Dale L. Pitt before a luncheon of the Association of Professional Engineers of B. C.

Among visitors from outside the province were the following: L. E. McMeans, R. W. Jennings, E. J. Carlyle, G. H. Rainville, and N. E. Atchison, Montreal; Dr. Charles Camsell, Ottawa; E. H. Orsen, Kirkland Lake; A. W. Wilmot, Greenwood, N. S.; C. C. Huston, J. Graham Eby, Bertrand Robinson, F. C. Buckland, E. H. Doyle, P. B. McConnell, G. Allan MacPherson, W. A. Gow, and Richard Pearce, Toronto; W. D. Caruthers and C. G. Ross, St. Catherines; R. R. Spencer, Dundas, Ont.; M. S. Matheson, North Bay, Ont.; Fred V. Seibert, F. D. Shepherd, George E. Cole, D. O. Davies, and E. W. R. Butler, Winnipeg; Paul Glidden, Yellowknife, N. W. T.; G. E. Darroch, Calgary; and John O. Wheeler, Banff. The following visitors from the United States also signed the register: G. E. Jarpe, Milwaukee; Tom Muff, Los Angeles; LaMont West, Salt Lake City; P. C. Peddersen, C. Y. Garber, and W. G. Woolf, Kellogg, Idaho; H. A. Pearse, Chelan, Wash.; Harry Townsend, O. H. Solibakke, G. C. Grange, Dale L. Pitt, John Hooland, and B. G. McLeod, Seattle.

★In a report to the Canadian Institute of Mining and Metallurgy at Vancouver recently, Dr. Hartley Sargent, chief mining engineer of the B. C. Department of Mines, estimated the value of mineral production in British Columbia during 1945 at $54,600,000, approximately $300,000 less than that during 1944. In the "Principal Metals" group he anticipates a gross value of $42,340,000, compared with $39,677,888 in 1944. Mr. Sargent stated:

"Prospecting, exploration, and development have been going on actively in several parts of the Province. Most of the activity has been directed towards the ultimate mining of gold. The results obtained so far, the activity of prospectors, and the interest shown both by British Columbia and outside capital are encouraging. We can expect that some of the depletion of the war years will be made up fairly soon, provided the cost of production and the rate of taxation permit sufficient return to keep capital interested."

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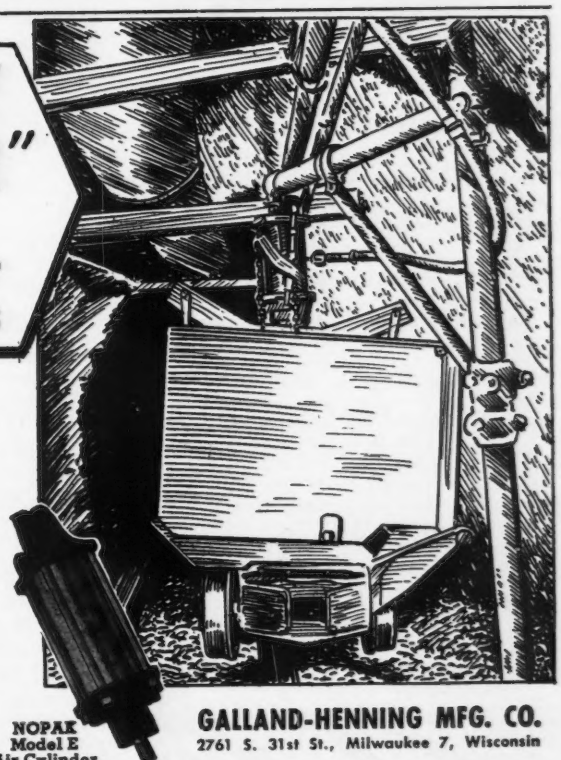

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Canada *(continued)*

announced the enlarging of capacity of its concentrator at the Polaris-Taku mine, Atlin mining division, to 400 tons daily, with the objective of 500 tons in the near future. Installation of a new Symons cone crusher and other equipment is expected to reduce treatment costs. Frank H. MacPherson, general manager, estimates 30,000 tons of broken ore, almost all above the main-adit level, to be available for milling.

★Privateer Mine, Ltd., Clayoquot Mining division, plans to resume production Feb. 1, 1946. A crew is now at work and the breaking of ore has commenced. Reserves are estimated at 23,870 tons averaging 0.44 oz. gold per ton. C. Harry Hewat will again be mine manager.

★During the quarter ended Sept. 30, Bralorne Mines, Ltd., Lillooet mining division, produced 11,580 oz. gold, valued at $445,830, from 21,953 tons, averaging 0.53 oz. gold per ton. Production for the three quarters of 1945 is 43,264 oz. gold, valued at $1,665,664, from 78,663 tons, averaging 0.55 oz. gold per ton. A connection between the Empire and Crown shafts has been effected on the 18 level, thereby improving ventilation on and facilitating the development of the lower levels. The Bralorne company has dropped its option on the Ben d'Or group, also in the Lillooet division.

★One of the most active companies in British Columbia during the past year has been Quebec Gold Mining Corporation. One subsidiary, Pacific (Eastern) Gold Mine, Ltd., is developing the P. E. mine, adjoining Pioneer in the Lillooet division, and reports encouraging progress. Another subsidiary, Pellaire Gold Mines, Ltd., has established the downward persistence of veins exposed by high-grade surface outcrops at the Hido mine, in the Clinton mining division. A third subsidiary, Kenville Mines, Ltd., is intensively exploring the opportunities of returning the Granite-Poorman mine, Nelson mining division, to production. The Quebec Gold company has recently secured options on the Nancy Bell property, on Texada island, Nanaimo mining division, and on the L. and H. mine, in the Slocan mining division.

★Grull-Wihksne Gold Mines, Ltd., reports intersection at 616 ft. length, 500 ft. below the surface, of 20 in. of ore averaging 0.5 oz. gold per ton. The vein occurs in soda granite, through which the drill has passed into Pioneer-type greenstones. Drilling is being done on the Alma claim, across Cadwallader Creek from the Bralorne mine.

★Island Mountain Mines Co., Ltd., Cariboo mining division, produced 867 oz. gold, valued at $33,395, from 1,848 tons, averaging 0.47 oz. gold per ton, during October. A dividend of 4c per share will be paid Dec. 20.

★October production of Cariboo Gold Quartz Mining Co., Ltd., was 1,039 oz. gold, valued at $40,001, from 2,792 tons, averaging 0.37 oz. gold per ton. An additional 252 oz. gold, valued at $9,702, was obtained from a ball-mill clean-up. During the month 32 men were added to the underground crew.

★Barkerville Mining Co., Ltd., has been formed and will develop properties in the Cariboo district. Financing has been undertaken by four Canadian mining companies, including Pioneer Gold Mines of B. C., Ltd., Transcontinental Resources, Ltd., Leitch Gold Mines, Ltd., and another Eastern company. Directors include Dr. Howard T. James, F. W. Guernsey, G. M. Warren, Ross Thompson, W. B. Milner, and a sixth yet to be named.

★Hedley Mascot Gold Mines, Ltd., has located, as a result of stripping by a bulldozer, an orebody 400 ft. distant from the glory hole on the Wheeler group, held on option. The vein averages 15 ft. wide over an exposed length of 30 ft. and averages 0.58 oz. gold per ton at one end and 0.11 oz. at the other. The Wheeler group is 2½ miles distant from the Mascot mine, in the Osoyoos mining division.

★Sheep Creek Gold Mines, Ltd., is currently milling about 80 tons of ore daily. The improvement in the labor-supply situation is expected to provide for continuous operation henceforth. The wholly-owned subsidiary, Zincton Mines, Ltd., has resumed milling at the Lucky Jim mine, Slocan mining division, after a brief suspension caused by loss of markets when United States smelters became glutted. Zinc concentrate is now being shipped to Trail.

YUKON TERRITORY

★In a detailed report at the annual meeting of the B. C. Division, C.I.M., Dr. Charles Camsell, Deputy Minister of Mines and Resources, Ottawa, stated 21,398 oz. gold had been produced in Yukon during 1945 to the end of August. This is about 5 percent higher than in the same period of 1944.

★The Yukon Consolidated Gold Corporation, Ltd., is operating three dredges in the Dawson district: one in the Klondike valley, one on Quartz Creek, and the third on Middle Hunker Creek. Excellent results were obtained on Middle Hunker Creek and the other two locations gave satisfactory returns. Stripping and thawing operations, however, have been greatly restricted owing to the shortage of labor. Full-scale production will be impossible until ground has been prepared in at least seven dredging areas. Clear Creek Placers, Ltd., operated its dredge successfully on Clear Creek and the associate company, Yukon Alluvial Golds, Ltd., prospected with drills on Barker and

Thistle creeks. Numalake Mining Co., which has been drilling for placer gold on Scroggie Creek during the summer, plans to shift prospecting operations to other holdings in the Dawson district, as well as to Gladstone Creek in the Kluane Lake area of the Whitehorse district.

★Conwest Exploration Co., Ltd., has taken an option on lode properties of Treadwell-Yukon Corporation, Ltd., in the Mayo district. The Consolidated Mining & Smelting Company of Canada, Ltd., has an engineer in charge of a small crew engaged in exploratory work on claims in Dublin Gulch. In the Swift River area of southern Yukon, Hudson Bay Mining & Exploration Co. has been drilling on its group of claims at the head of Log Jam Creek.

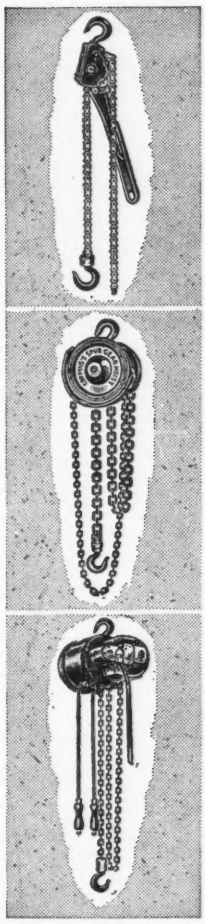
MEXICO

Labor demands 40 percent pay increase—Cooperatives are having serious difficulties

★Mining in Mexico faces current difficulties because of the sudden hiking by the U. S. government of the buying price of foreign silver, and labor unrest. Leaders of the 33 silver sections of the national miners union have served notice that they will order their some 35,000 members to strike on Dec. 17 if the employers do not yield to their demand for a 40 percent wage lift. The leaders calculate this increase will benefit the silver miners to the amount of 25,000,000 pesos ($5,150,000) a year. The employers have made it plain that they cannot afford to meet the demand. They aver that production and transportation costs and taxes will leave them only a mild profit from the 71.111c price for their silver. Finance Minister Eduardo Suarez told Mexico City that the government is entitled to take a goodly share of profits from the raised silver price because, he was quoted as saying, natural resources are the nation's patrimony and must be government-protected.

The government has helped silversmiths by exempting them from the 12 percent excise tax on exports of their products. The government has been encouraging silverware exports for some time.

★Transportation for mining has improved slightly. Although the National Railways, the largest railroad, has bettered freight service to some extent, with the operation of more cars and locomotives, mostly obtained in the U. S., and reconditioned rights-of-way, its facilities are still below par. The railroad, government-administered, continues to be hampered by the serious problem of rented U. S. box cars. Estimates are that some 8,000 of these cars are still in the Railways' service, and though neces-



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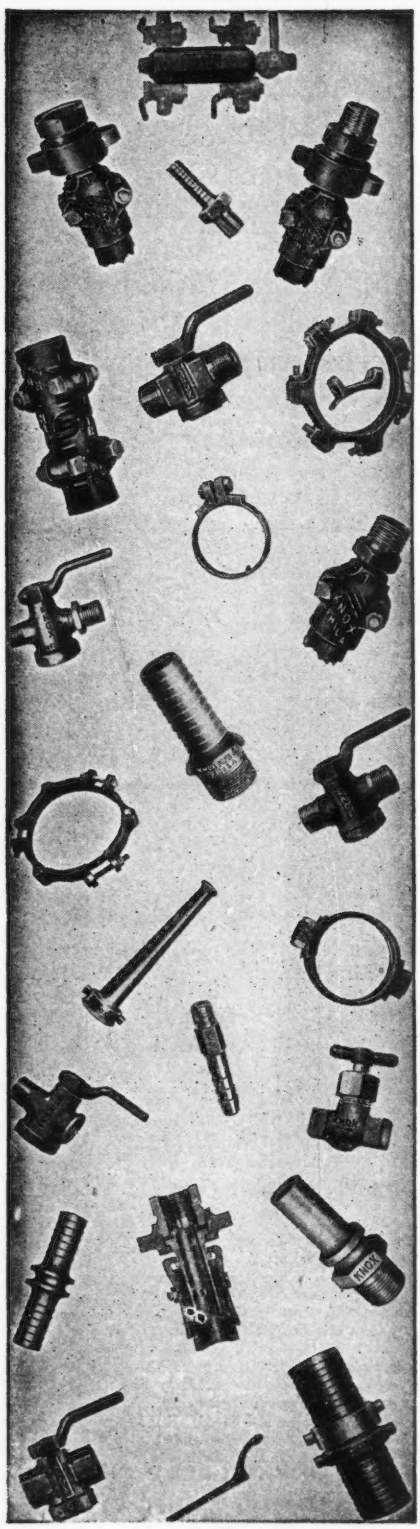

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Mexico (*continued*)

sary, represent a serious expense, as their rental is $1.25 (U.S.) each. American railroads are clamoring for the return of these cars. The Railways is returning some of the cars, and in doing so is attempting to relieve freight congestion by moving them loaded instead of empty to the border.

★Sea shipping facilities have become available for mining, but as yet to only a small extent, though exports of mining products, with lead predominating, have resumed to Europe, mostly Great Britain and Sweden, with the movement of 43 carloads through Tampico. American Smelting, Cia. Minera Asarco, and Cia. Minera Penoles are mentioned as the principal shippers.

★Two large mining cooperatives and one small cooperative are in grave economic difficulties. The state and federal governments are now controlling the San Rafael, Pachuca, Hidalgo, one of Mexico's pioneer organizations of the kind, which was recently forced to suspend work because of a series of cave-ins in its chief mine, said to have resulted from careless blasting. The society's 900 members are jobless. Ministry of Finance auditors, examining the society's books, as the federal government desires to recover the 500,000 pesos it loaned the cooperative, are reported to have discovered dangerous juggling, padded payrolls, and false entries of machinery sales. The members have asked the Ministry of National Economy, supervisor of all cooperatives in Mexico, to aid them in prosecuting executives of the cooperative alleged to be responsible for tampering with the books. An electric power bill of 1,300,000 pesos is owing.

★The Dos Estrellas, which for several years has been working properties which the French-owned Cia. Minera Dos Estrellas, S.A., abandoned because the work was unprofitable at El Oro, State of Mexico, and Tlalajhua, Michoacan, has asked the federal government for a 500,000-peso ($105,000) loan. The chief causes of this cooperative's troubles, the directors say, is diminishing manpower. Only a little more than 2,000 remain. The society has lost heavily in membership to higher paying Mexico City factories. Its directors say the higher price for Mexican silver in the U. S. is of no benefit to the society, because of high production and transportation costs and taxes.

★El Brote cooperative, El Brote, Guanajuato, has appealed to the federal government to help it pay creditors who loaned 500,000 pesos on most of its machinery and equipment, and threaten to foreclose unless the loan is repaid.

★The national commission for stimulation of the mining industry plans to expand the chain of small to medium metal-treatment plants it operates, mostly for the benefit of small operators and prospectors. It has sent engineers, headed by J. J. Falomir, to seek a site for a plant of unspecified capacity in the Culiacan zone, Sinaloa. This plant is intended to service a wide sector of the central northwest.

★Vera Cruz has prospects of entering Mexico's mining belt. Reports are that Mariano Sanchez Rivera, Perote, Vera Cruz, is arranging with A. Brady, J. Brinkman, and E. Searle, mining engineers, representatives of New York interests, for the organization of a company to work properties he owns at Altotonga, near Perote. The American engineers are said to have been favorably impressed with the examination they made of the tracts.

★Properties at Santa Rosalia, Baja California, of the Cia. Minera de El Boleo, S. A., a French-owned copper-mining enterprise, Auguste Nopper, manager, were considerably damaged by floods resulting from storms that swept land and sea. No casualties were reported, though employees of the firm, members of the national miners union, appealed to the federal government for medical and other aid for themselves and families. The aid was rendered by airplane.

★Mining is being cramped by control which the federal government has established on imports of iron and steel products to assure their equitable distribution. Mining companies have tried to buy these products from Mexican manufacturers who thus far have been unable completely to meet the demand. It has been necessary, therefore, to place orders in the U. S.

★Cananea Consolidated Copper, Cananea, Sonora, Charles Montague, vice presidente, Gante, No. 15, Mexico City, and Albert Mendelsohn, general manager, Cananea, has its new 12,000-ton treatment plant in service, along with its old 3,000-ton plant. The copper situation, the slump in buying in the U. S. plus the 4c per pound duty on the metal, is restricting operations. The company is currently employing about 2,500 men. Transportation is good for this company because of its proximity to the U. S.—only about 50 miles south of Arizona.

★So important is mining to Mexico that it must have a special bank to finance it adequately and better to enable it to confront postwar conditions, according to Gen. Francisco Artigas Barbedillo, prominent mining man, who presented a proposition to the Ministry of Finance for the organization of a semi-official bank, the Banco Minero, to be financed by the government which would buy half its stock, and the rest being made available to private interests, preferably mining.

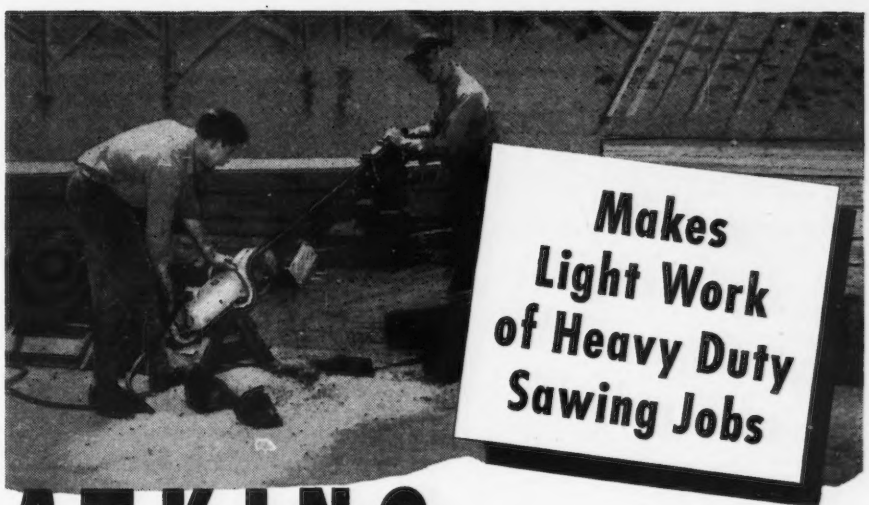
The bank, which would be a deposit and financing institution, would finance mining companies and operators in Mexico that need cash for installing metal treatment plants and refineries, obtaining machinery, and reconditioning equipment. It would control the production of all its stockholders.

★The national railroad workers' union has asked the Ministry of Communications and Public Works to raise railroad freight rates on mining products and to authorize the lines to charge mining companies for hauling their ore to smelters or treatment plants. The laborites told the Ministry that the preferred reduced freight rates which mining is enjoying is a bad thing for the railroads and warned that unless the National Railways is allowed to raise these rates it will soon go into bankruptcy, as 20 percent of its cargo business is ore and other mining products.

★Drastic downward overhauling of taxes on mining—concessions, proprietorship, production, and income—was urged upon Ing. Gustavo P. Serrano, Secretary of National Economy, a prominent mining engineer, who before joining the cabinet was president of the Mexican Mining Association, by the Mexican Mining Chamber, Gante, No. 15, Mexico City. Unless the mining situation changes radically and quickly, only the large operators will be able to remain in business, the Chamber warned. It said that medium and small operators are essential to the industry and must be aided. Small operators, the Chamber said, find their production down to 45 percent of what it was a few years ago, and ore these enterprises ship to smelters and treatment plants decreased to 904,041 tons last year from 1,309,643 in 1937. It asserted that an excellent way to save mining is to start immediately encouraging investments in the industry so as to create "an ambient of security, rights, and optimism" among investors.

★The Confederation of Mexican Workers, Mexico's strongest work organization, is urging increasing the minimum daily wage to 5.94 pesos ($1.26) for 1946 and 1947. It has been 3.30 pesos since 1944.

★A promising scheelite deposit has been discovered in the Yerbaniz Range in the State of Durango, in the old Orito gold district formerly worked by American operators and now by "gambusinos," situated about 7 miles from the town of El Penon, by A. J. McCormick, of Durango City. The presence of scheelite in ores from El Orito was discovered by Mr. McCormick when he tested samples with an ultra-violet lamp. He denounced a claim of 16 hectares after inspection of the ground later visited by R. M. Atwater, Jr., mining engineer. According to Mr. Atwater's report, there is a granite-limestone contact at the McCormick location, starting



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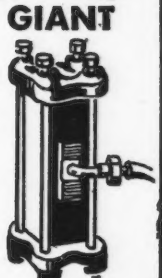
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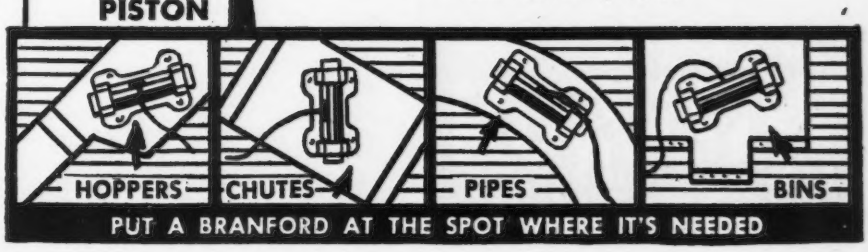

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Mexico (*continued*)

from the northern edge of the flat on the Covadonga side of the Yerbaniz Range and continuing all the way up the hillside, diagonally, in a northwesterly direction for a distance of at least 1,000 meters. At the foot of this contact outcrop former operators sank a shallow shaft on the granite footwall of the contact, crosscutting at the bottom of the contact zone. They were evidently searching for gold, but the contact ore at this point carries only ½ gr. of gold per ton. In the arroyo, 100 ft. downhill from the shaft, the contact zone is exposed but not cleaned off. Considerable garnet and contact material are visible. The McCormick claim covers a length of about 500 meters on the lower end of the outcrop. Strike is northwest, dip 70 deg. to the east, and easterly inside the 16-hectares area there is a basin in the hillside where another contact is situated. The gold district in which the scheelite deposit lies can be reached from the town of El Penon by horseback over the old 7-mile mine road built by the former operators. El Penon is 20 miles by bus from Yerbaniz, a station on the Torreon-Durango branch line of the Mexican State Railways.

AFRICA

Company alliance to facilitate Free State development — Gold realization charges are discontinued

★The Anglo American Corporation of South Africa announces that it has acquired 149,850 fully paid shares of £1 each in the capital of Lewis & Marks, Ltd., out of a total issued capital of 150,000 shares. The latter company, adds the announcement, has a large shareholding in African & European Investment Co., and the acquisition of the shares in Lewis & Marks, Ltd., will, with the interest already held by the Anglo American Corporation in African & European Investment Co., through one of its allied companies, bring about a close association between the corporation and the African & European Co. and its associated companies. The immediate significance of the announcement is in its relationship to developments in the Free State. The new development places the Anglo American Corporation in a singularly advantageous position to go ahead with plans for opening up the proved gold-bearing areas south of Odendaalsrust. As is generally known, the mining conditions in the Free State are not expected to be easy, owing to the heavily faulted ground that exists in some of the proved areas. Technical difficulties are expected to be encountered when the first steps are taken to develop new mining properties. Some of the heavily faulted ground is believed to lie between the Western Holdings properties and the southern part of African and European's Block 7. It has previously been suggested that development could best be proceeded with if comprehensive plans could be made for the whole of the southern part of the proved areas to be worked as a single unit. This can now be done and cognizance taken of the large sums of money that will be needed to bring the new mines to production in this area.

★The announcement by the Minister of Finance that gold realization charges will no longer be levied after Oct. 1 was welcomed by the industry, which regarded the charges as being unjust, inequitable, and against the best interests of the industry. Levying the charges was a convenient way of increasing revenue without actually raising taxation.

At the present gold price of 172s. 3d. per ounce, the charges represent about 3s. 4½d. per ounce. Consequently, reduction in costs on mines like Sub Nigel and Blyvooruitzicht, working in 11 dwt. ore, should amount to 1s. 10d. per ton. On lower-grade properties the reduction would be correspondingly lower.

★The value of stores purchased by the mining industry in South Africa last year was £32,803,040, compared with £30,910,540 in 1943. These figures represent the outlay by large mines only and do not include purchases by small concerns, which amounted to £729,578 last year and to £849,201 in 1943. Some of the largest items in last year's mining outlay were: Cyanide, solid, £677,396 (S. A., £336,122); steam coal, all S. A., £1,053,141; electrical machinery, £867,029 (S. A., £330,349); gelignite, gelatine dynamite, all S. A., £1,505,707; dynamite and ligdyn, all S. A., £996,970; capped fuses, £1,126,541 (S. A., £225,308 and imported £901,233); meal, all S. A., £1,062,043; meat, all S. A., £1,555,083; machinery and machine tools, £535,267 (S. A., £222,995; imported £312,272); machinery spares other than electric, £994,505 (S. A., £648,382; imported, £346,123); iron and steel piping, £515,299 (S. A., £505,167; imported, £10,062); tube-mill steel balls, £474,129 (S. A., £473,398; imported, £731); rock drill spares, £643,956 (S. A., £516,461; imported, £127,495); rock drills, £55,885 (S. A., £10,085; imported, £45,800); detachable bits, £94,807 (S. A., £61,532; imported, £33,275); wire ropes, £653,630 (S. A., £650,751; imported, £2,879); rock-drill steel, £468,676 (S. A., £420,061; imported, £48,615); poles, lagging and pack mats, all S. A., £1,955,705; miscellaneous timber, £608,570 (S. A., £520,004; imported, £88,566); trucks and spares, £418,385 (S. A., £380,161; imported, £38,224); water, £405,633; compressed

air, £576,445; and electric power and light, £4,436,618.

★At the meeting of Union Minière du Haut-Katanga, in July, shareholders were informed that the company's copper production last year totaled 165,484 tons, which was entirely taken by the British Government under contract, of which notice of termination was given at the end of October. Last deliveries were made in January.

Ore reserves show an increase. Total 1944 extraction was 2,147,000 tons, comprising copper ores, cobalt, zinc, and cadmium. Sales of cobalt and radium increased considerably. Output of tin was 1,260 tons; zinc, 24,700 tons (shipped to Belgium); silver, 81,156 kilos; gold, 43 kilos. The new concentration plant was in operation at Kilwezi.

★At about midnight on Sept. 1 an accident occurred at 15a subvertical shaft of Crown Mines, Ltd. A winding rope which was being changed and had been disconnected from the drum of the winding engine got out of control and fell down the shaft, carrying with it a skip from the 19th station and causing extensive damage to the shaft equipment. Unfortunately, four natives were killed. Repairs have been completed and the shaft is in full commission.

★The workshop of the Rooiberg Minerals Development Co., Ltd., at Rooiberg, and the contents of the buildings were destroyed by a fire which broke out early on the morning of Monday, Sept. 17. The amount of the loss has not been ascertained.

★Gold Fields Rhodesian Development Co. has exercised options on the B. & S. Mine and on the adjoining Fossicker, Jupiter, and other claims. The area amounts to approximately 300 claims and is situated in the Bubi district of Southern Rhodesia, about 60 miles north of Bulawayo.

★Addressing the Bulawayo Chamber of Commerce, the chairman of the Industrial Development Commission revealed that big deposits of phosphate had been discovered in the Colony. The Commission is carrying out investigations to determine the size and the chemical formation. In stressing the importance of the discovery to the farming community, the chairman expressed the hope that another industry would grow out of the discovery.

★The total output of gold and other metals and minerals from Southern Rhodesia for July, 1945, amounted to £669,586, compared with £671,702 for the previous month of June. The summary of mineral production in July was as follows:

Gold (47,972.16 oz.)	£413,160
Silver (8,705.36 oz.)	852
Base metals and minerals	255,574
Total	£669,586

★The fatality rate in gold mines of the Witwatersrand and extensions in July was the exceptionally low figure of 0.87 per 1,000 per annum based on the estimate of 346,250 persons employed. The rate was the lowest so far for this year, the next lowest having been 1.24 in February. There were 25 deaths in July, compared with 35 in February. The highest number in any one month this year was 53 in March, when the fatality rate was 1.82. Of the 25 deaths in July nine were caused by falls of rock and seven were due to truck and tram accidents.

★With the August analysis of gold-mining production, the Transvaal Chamber of Mines has given the adjusted figures for the eight months of the year. The figures given previously in respect of the period January-May inclusive were based on a gold price of 168s. an ounce. Early in June, it will be recalled, it was announced that the price of gold had been increased to 172s. 3d. an ounce, retroactive to Jan. 1. Another factor is that from April 1 the mines have had to meet the whole cost of the increase in native wages made under last year's award, because of the discontinuance by the Government of the remission of the gold realization charges. These charges, it has now been announced, are to be withdrawn as from Oct. 1.

The accompanying table gives the eight months' comparison:

	1944	1945
Milled tons	39,211,200	39,188,900
Yield, oz.	8,223,755	8,126,650
Yield, oz. per ton milled	4.036	3.996
Working revenue	£66,730,288	£67,754,155
Working revenue per ton milled	34s.	34s.7d
Working costs	£44,630,877	£46,273,514
Working costs per ton milled	22s.9d.	23s.7d.
Working costs per ounce	112s.10d.	118s.2d.
Working profit	£22,099,411	£21,480,641
Working profit per ton	11s.3d.	11s.
*Dividends	£6,737,751	£6,389,843

*Including inter-company payments in 1944 of £272,754 and in 1945 of £268,755.

AUSTRALIA

Government action required to rehabilitate gold mining—Broken Hill's iron and steel operations described

★Variation in the activity of Australian gold mining is simply shown by employment figures for three periods. In 1913, when the industry was at a peak of prosperity, employees numbered 33,525. In 1929 employment fell to 6,108; from 1929 to 1935 employment rose to 32,694 men, and remained about this level until the outbreak of the recent war. Because of the war employment has fallen to approximately 6,000 men in the country's gold mines. The time for rehabilitation is overdue, but, so far, no Government action toward this nationally important objective is ap-

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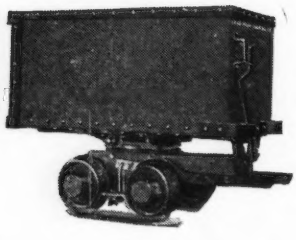

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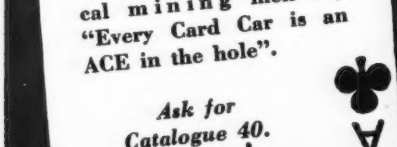

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Australia *(continued)*

parent, beyond a recent statement by the Prime Minister that sympathetic consideration would be given to the industry's request for the release of men and the replacement of impressed and deteriorated machinery. Apart from labor and machinery, some mines will require fresh capital, where operations were carried on too long with inadequate labor and output. Capital must also be attracted to new undertakings, and to accomplish this, drastic and generous amendment of company and individual taxation is essential.

★Broken Hill Proprietary Co., Ltd., is Australia-wide, for its operations are carried out in all states of the Commonwealth. In the year ended May 31, 1945, the company earned a net trading profit of £A428,619 after deducting £A1,161,538 for depreciation on fixed assets, £A283,757 for special depreciation no war-time plant, and £A825,000 as provision for taxation. The year's operation suffered seriously by coal shortage caused by industrial disputes and absenteeism from the company's collieries. Resumption of gold-mining activities was prevented by the unchanged manpower position. The company's main activity, production of iron and steel, had, in consequence of the coal position, to be drastically curtailed and it became necessary to cease iron smelting at Whyalla, South Australia.

The Broken Hill Proprietary Co. has been the foundation of Australian defense. It provided a steel ingot capacity of 2,000,000 tons per annum, and established the manufacture of other metals and alloys, among the most notable being tungsten carbide and magnesium.

Iron ore is obtained from the Middleback Ranges, in South Australia, and shipped to the smelting and manufacturing centers of Newcastle and Port Kembla, in New South Wales. Fuel for the smelters is obtained mainly from the company's own collieries. Mines on the Maitland coalfield supply the Newcastle works and the South Coast collieries deliver their coal to Port Kembla, modern byproduct coking plants being established at both centres. Smelting of iron ore was commenced at Whyalla, in South Australia, which is also the shipping port for ore for the smelters in New South Wales. A ship-building yard was established at this center. This yard has constructed numerous ships for the navy and the merchant service, and seven steamers are now in various stages of construction. The company will expand its own shipping fleet to provide transport from the Cockatoo Island deposit, at Yampi Sound, Western Australia, and four ships of 12,500 tons' deadweight will be built.

The iron-ore mines in South Australia worked to the capacity controlled by available shipping, and the deficiency in supply to the smelters was made up by the production of 1,364,141 tons of ore from small deposits in New South Wales. These deposits are now idle, as production was uneconomical in comparison with supplies from Whyalla. To insure future supplies options have been taken over large iron-ore occurrences in New Caledonia. Development and equipment is proceeding at the ironstone deposits on Cockatoo Island, Yampi Sound, Western Australia, which contain ore of remarkably high grade, which is low in manganese and suitable for blending with the South Australian ores. Production may commence by the end of 1946. Ore will be crushed by an 84x60-in. crusher, manufactured in the company's workshops, where electric shovels are also being built for handling broken ore in the quarry.

Crushed ore will be loaded direct from the bins at the crushing plant into ships' holds. Limestone flux for the smelters is obtained from the quarry at Rapid Bay, South Australia, and quarries at Devonport, Tasmania. In addition to the disability caused by industrial troubles and absenteeism, the output from the company's coal pits was under the control of the Coal Commissioner, and many hundred thousand tons mined were diverted to other consumers. Mechanization of the mines has proceeded actively and a high stage of mechanical efficiency has been attained. All plant and equipment has been manufactured at the company's workshops.

Among the lesser activities of the organization is aircraft manufacture and more than 1,000 were produced to May 31, an achievement rendered possible solely by the company's organization and resources. Equipment for the munitions program entailed the building of many milling machines, heading and forging presses of large size, and the production of special tools and gages, most of which were hitherto unattempted in this country. Annexes turned out vast quantities of ammunition, and the output of armor-piercing and high-explosive shell bodies exceeded 35,000 per week. Other production included all types of gun barrels and other munition components. A process for the manufacture of tungsten carbide was quickly evolved to meet the emergency, and bullet-proof steel plate was invented by the research staff. Alloys were not available to make the conventional plate, but a substitute alloy was developed from a mineral found on the coast of New South Wales. This plate met all ballistic requirements, had excellent weldability, and large tonnages could be produced quickly by simple methods. The establishment of ferro-alloy, and magnesium plants were very important developments, as well as the production of a large range of special steels. Subsidiary companies produce a wide range of steel castings and other products, including

stainless-steel sheets, and wire mills and rope works have operated to full capacity and are to be expanded.

Considering the absolutely vital nature of the company's work to the war operations, it is hard to understand the Government attitude to its labor requirements, for the labor position became so acute at various times that it was necessary to close down auxiliary plant and to transfer men to producing units in order to maintain maximum output of steel. With the end of the war, 4,000 employees will be reinstated in pre-war occupations, from the fighting forces, and consideration and assistance will be given to any desired vocational changes.

WESTERN AUSTRALIA

★Central Norseman Gold Corporation, N. L., at Norseman, 160 miles south of Kalgoorlie, reported a lower output and greatly reduced development. Profit for the financial year amounted to £A98,477, after writing off development redemption. During the year the mill treated 75,548 tons of ore having an average grade of 8.0 dwt. gold per ton, for a recovery of 29,143 oz. of gold and 18,657 oz. of silver. The average grade recovered was 7.72 dwt gold, and 4.94 dwt. silver per ton. The high silver content of the Norseman bullion is unusual in Western Australia. Development work, including prospecting on an adjacent reef, and driving in the newly reopened Princess Royal mine, totaled 3,570 ft., of which 473 ft. was in ore 50 in. wide, and assaying 9.8 dwt. gold per ton.

The principal reef in the mine is the Mararoa, which has a length approximating 3,000 ft. and underlays east at 45 deg. The lode material is quartzose in amphibolite country, which is intersected to a marked degree by porphyry dikes. The average lode width is 7 ft., with enlargements up to 30 ft. The company's other mine, the Princess Royal, lies to the north of the Mararoa Reef. It was a good producer down to No. 9 level in the early years of Norseman, but has been idle for more than 20 years. As the result of good values in diamond drill cores, the workings were unwatered early in the year, and driving is in progress at Nos. 7 and 9 levels. This work accounts for the large proportion of development work that was not in ore. Ore reserves in the Mararoa Reef were estimated at 228,000 tons having an average grade of 7.0 dwt. gold per ton. The company also holds the Lady Miller mine, in which ore reserves were estimated at 21,000 tons assaying 7.2 dwt. per ton.

NEW SOUTH WALES

★Zinc Corporation, Ltd., Broken Hill, reported a gross profit of £A378,587 for the financial year ended Dec. 31, 1944. During the year tons milled

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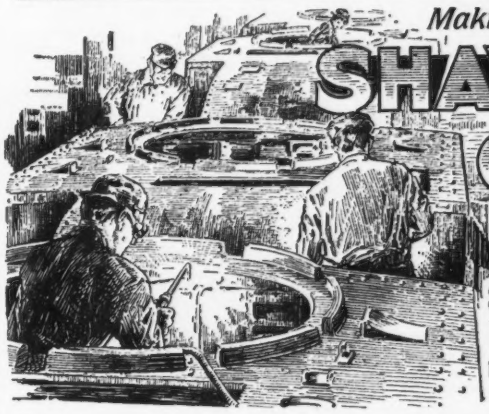

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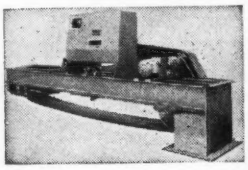
BULLETIN 551



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were 444,450. Lead concentrates produced contained 65,001 tons of lead and 1,580,078 oz. silver. Production also included 85,884 tons of zinc concentrates. Ore reserves at Dec. 31, 1944, were estimated at 4,100,000 tons in the lead lode and 277,000 tons in the zinc lode.

Ore milled during 1944 contained 15.7 percent lead, 3.8 oz. silver, 11.5 percent zinc, which compares with 16.2 percent lead, 3.9 oz. silver, and 11.3 percent zinc for ore milled the previous year. Percent recovery was 96.9 for lead, 93.9 for silver, and 87.6 for zinc.

NEW ZEALAND

★Blackwater Mines, Ltd., in the South Island, reported that labor shortages were largely responsible for a decrease in working profit from £ Stg. 47,825 in 1943 to £ Stg. 30,694 in 1944. Of this profit New Zealand gold duties took £16,299. Tonnage milled during 1944 was 31,604, having an average assay value of 8.87 dwt. gold per ton. Recovery was 13,169 oz., equivalent to 93.91 percent. Development work completed was 1,553 ft. which included 1,211 ft. of drifting. The main shaft has been sunk to No. 16 level, intersecting the reef 72 ft. and 82 ft. below No. 15. Ore reserves were estimated at 80,267 tons carrying an average of 9.57 dwt. gold per ton.

Philippine Mines

(*Continued from Pg.* 112)

generators are intact. Power lines were destroyed. The mine is completely caved, and the headframe lies twisted from the effects of main shaft fires. Thirty men are employed in the mine, mill, and power plant. The 100 level is being cleaned to the main shaft, and 500 ft. of the 100 level has been cleared. Former mill capacity was 1,200 tons per day, and the power plant rating was 2,300 hp.

Antamok Goldfields Mining Co. The mill and power plants were looted or burned, and only the staff house remains. Grass and shrubs cover former sites of the power house, assay office, hospital, mess hall, and two or three staff houses. The main haulage level appeared to be in fair condition, except for occasional caves and ground sloughs. Rail and pipe were removed from at least the first 100 ft. of the main tunnel. Roads leading to the upper level were overgrown with grass and shrubs.

Cal Horr Mining Co. This mine, which is owned and operated by the Benguet Consolidated Mining Co., had its own power plant and a mill with capacity of 250 to 500 tons per day. The mill is in good condition except for the ball mill and crushers, which were removed by the Japs. Nine laborers' quarters and one staff house remain. The power plant, diesel engines, and mill roofing were also removed by the Japs and looters.

Considerable caving took place in the main drainage tunnel and in all surface working. The property could be made to operate at its rated capacity after the power plant is restored. Repair of the drainage tunnel is under way.

Itogon Mining Co. Access roads, including the provincial road and approximately 3 km. of the company's road, are in fair condition. The 1,000-ton mill and large power plant, with supplementary connection to the City of Baguio, were looted or destroyed by bombing. The few staff houses which remain are decaying, and furniture, boards, and roofing are being looted by the people. Shaft timbering is in poor condition and the steel headframe was destroyed. Tunnels in the upper workings and the main level are caved in.

Demonstration Gold Mines, Ltd. At the outbreak of the war the 250-ton mill at this property was milling approximately 150 tons per day. Mill heads were about 12 pesos. Bombs destroyed mill buildings, the power house, staff houses, and the mine office. The Hadsel mill, which was used as a washer to remove clay, is unharmed. Piping in the mill was completely destroyed, and the small equipment, such as pumps and motors, was looted. According to camp guards, the U. S. Army removed flooring, sidewall boards, and roofing of several small buildings and bunk houses for construction of camps. Rails were removed from the main haulage level, which is caved in. Upper tunnels are caved in also.

Baguio Gold Mining Co. Production of good-grade ore from this property was 400 tons per day prior to the war. Nothing remains of the power plant and surface buildings, and what little remained of the mill building was rapidly disappearing at the hand of looters. It is reported that the power plant machinery was dismantled by the Japs and removed to Manila. Mine tunnels are caved, and the ore skip from the portal of the main tunnel to the mill is badly damaged. Access roads to the property are usable.

Big Wedge Mining Co. At the outbreak of the war this company had just completed a 200-ton addition to its mill, making the total capacity 400 tons per day. Mill capacity was increased because of the discovery of a downward extension of the Keystone vein, which was opened up for 900 ft. on the 8 level, disclosing 30-peso ore over an average width of 25 ft.

Except for small parts which were looted from the mill and power plant, this property was the only one which did not suffer complete or nearly complete destruction. Machinery, pipes, and other equipment were greased, and the main tunnel was kept in repair. Mr. Neal, formerly mill superintendent, said that the property could not have been kept any better by anyone, under conditions that persisted during the past years, than by the Japs. The Japs assumed that the property belonged to them, he stated, and thus they took good care of it so that they could resume operations at the close of the war. Except for small parts which are missing the 375-hp. power plant is in good condition.

Although struck by three bombs, the mill can be repaired easily. Belts, pumps, motors, and other small mill parts were looted. One bomb hit the refinery, causing complete destruction; a second destroyed the old flotation unit, and a third destroyed the crushing plant. Damage to the second crusher was slight, however. Neighboring people opened the precipitate belt and looted 60,000 pesos' worth of gold precipitate.

Company staff houses and laborers' quarters are in place except for furniture and galvanized-iron roofing, which was looted.

Five hundred bunks were placed in the main haulage tunnel, which the Japs used as a hospital. The tunnel to the Frank and Broading vein was caved, but is being cleaned up. Shaft No. 1 in the Keystone section is completely caved in and is beyond repair. No. 2 shaft can be repaired.

Orders for missing mill and power plant parts have already been placed by the company, which expects to start operation as soon as parts arrive. Thirty men were employed to clean and repair mine workings, mill, and power plant.

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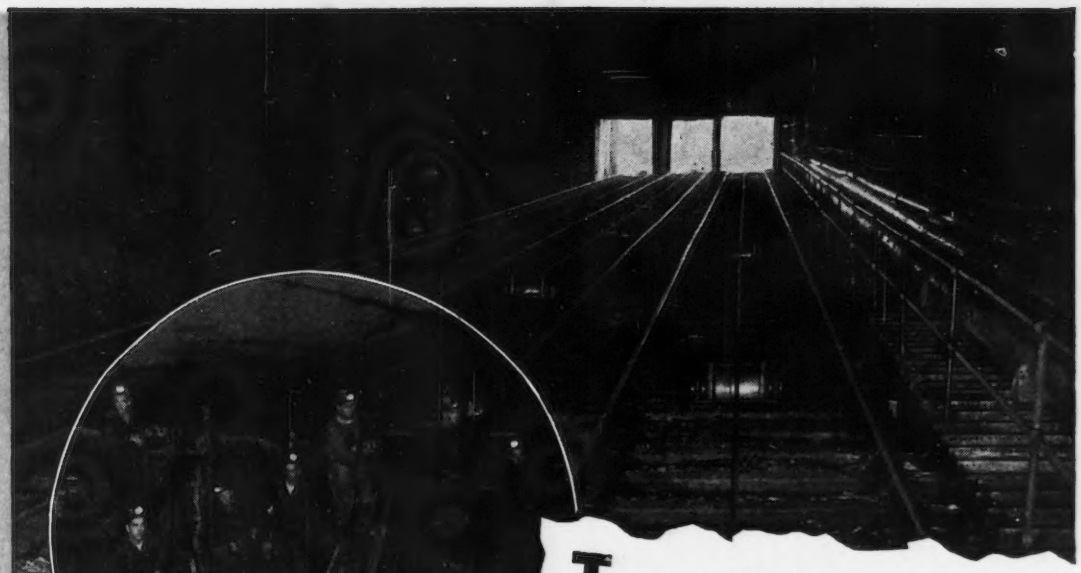

Main inclined shaft at a magnetite mine. Slope 33 degrees, height 9 feet 8 inches, width 28 feet 2 inches, and length 2000 feet. It will handle 8000 long tons of ore per day.

Insert shows DA-35 Power-Feed Drifters at work. Jackbits were used for all drilling. They were reconditioned with the JMA hot-mill and were reduced 1/16 inch in gauge.

Two of the largest shafts east of the Mississippi sunk with I-R Rock Drills and Jackbits

FAST DRILLING IS ESSENTIAL if the overall shaft-sinking time cycle is to be reduced. That is why the contractors on these two shaft jobs selected record-breaking DA-35 Power-Feed Drifters to do their drilling.

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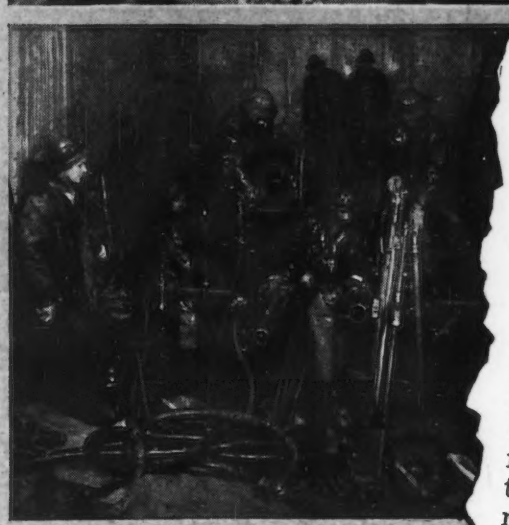
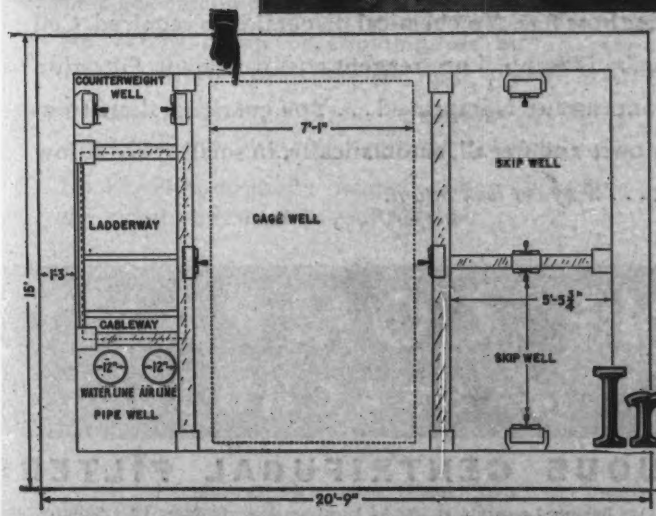
Jackbits were used on both jobs since they enable drill runners to get the most out of their machines. Less steel was handled, and the proper design of bit for the local rock conditions was chosen from the wide range of Jackbit types and sizes.



DA-35 Drifters in the New Leonard Shaft of the Warren Foundry and Pipe Co.'s Mt. Hope mine. I-R Jackhamers were used in place of the drifters whenever the rock was soft.



Cross section of the New Leonard Shaft. Total depth of this shaft is 2674 feet, and it will handle at least 6000 tons of ore per day. Jackbits were used for shaft sinking and for drilling bolt holes in the concrete for the steelwork that divides the shaft.

Ingersoll-Rand

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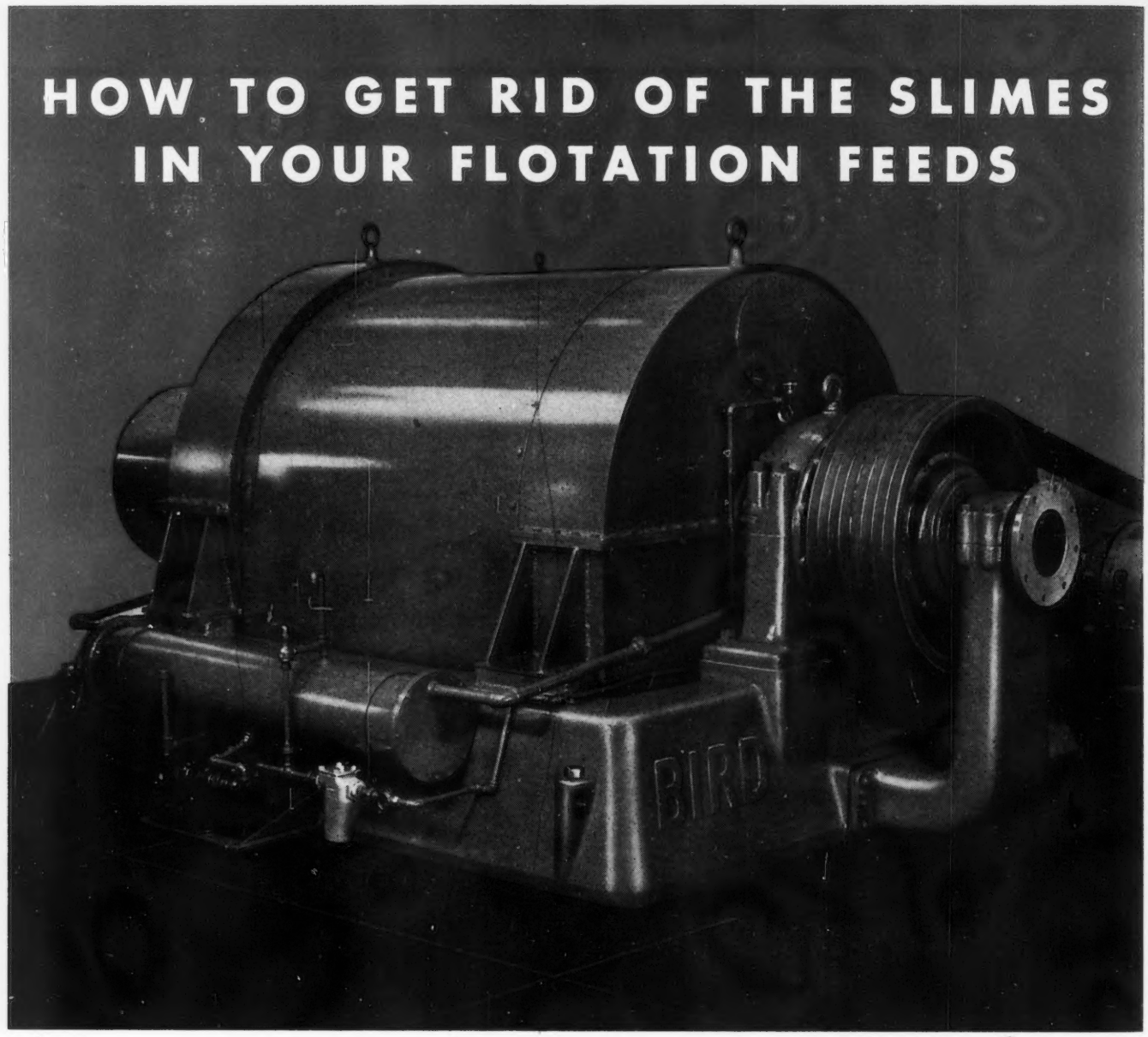
COMPRESSORS • CONDENSERS • TURBO BLOWERS • CENTRIFUGAL PUMPS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES

HOW TO GET RID OF THE SLIMES IN YOUR FLOTATION FEEDS



Without Losing Concentrates—
and Without
Using Dispersion Agents

It's easy! Just put this BIRD Classifier in your operating circuit . . . It cuts out the slimes as clean as a whistle, no matter how fine. No chemical dispersion is required. Cell capacity is stepped up, reagent cost cut down. Filtration of concentrates is improved . . . You get rid of slime troubles once and for all, automatically, in small space at low cost . . . *Why not look into it.*

BIRD MACHINE COMPANY

SOUTH WALPOLE • MASSACHUSETTS

BUILDERS OF BIRD CONTINUOUS CENTRIFUGAL FILTERS

ENGINEERING AND MINING JOURNAL. December, 1945. Vol. 146, No. 12. Published monthly at 520 N. Michigan Ave., Chicago, Ill. Editorial and Executive Offices: 330 W. 42nd St., New York 18, N. Y. Return postage guaranteed. Subscription rates: United States and possessions, $3 a year, $4 for 2 years, $5 for 3 years. Canada $3.50 a year, $6 for 3 years. Other countries in the Americas outside the United States and Canada, $4 a year, $6 for 2 years, $8 for 3 years. Great Britain and British possessions, 30s a year, 60s for three years. Elsewhere $5 a year, $10 for three years. Please indicate position and company connection in all subscription orders. Price of this issue 50c, or 3s. Entered as Second Class Matter, May 19, 1945, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

Here's why mining engineers everywhere praise the Cleveland Jumbo as the best mine rig obtainable:

1. **Insures greater speed in setting up and tearing down as compared with columns.**
2. **Only 2 hoses, air and water, to connect instead of 2 per machine.**
3. **No heavy lifting or straining, as encountered when operating drifters on columns or shaft bars.**
4. **Greater safety—no blocks to loosen up. Drifter can't fall—no smashed hands or strained backs.**
5. **No blocking normally needed; ceiling jacks handle usual variations in roof heights.**
6. **Drill holes are more accurately spaced, correct angles are more easily maintained; result—greater rock breakage.**

We can also furnish, if desired, a car for the Jumbo that is unexcelled as a time and money saver. Note these outstanding features: 1. All standard gauges obtainable. 2. Convenient bit and tool boxes and steel racks. 3. Mounting provided for flood light, which can be included at small additional cost. 4. When drifters are sold with the rig, water and air hoses are included for connecting manifolds to the machines. 5. Car includes 18" spoke type wheels, equipped with Timken roller bearings. 6. Prompt delivery of this equipment, with required priority.

Get all the facts on this remarkable equipment—write today for Bulletin 131A!

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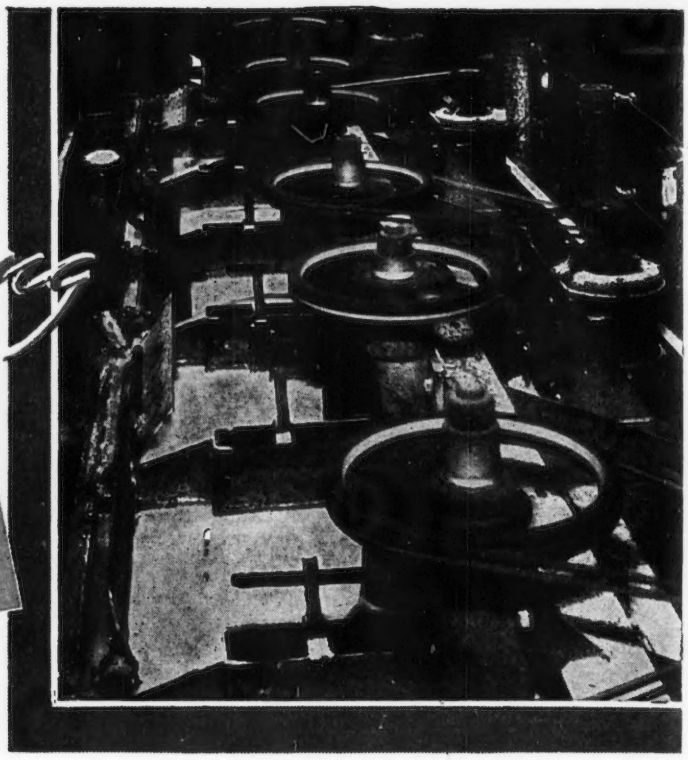
Leaders— in DRILLING EQUIPMENT

Beneficiating GLASS SAND — BY DENVER "SUB-A" FLOTATION



Flotation Enables Glass Sand Company to Meet Rigid Specifications

One of the many new flotation applications is that of cleaning sand for optical, flint, container and plate glass. Standard washing processes proved inadequate for meeting the more rigid specifications adopted for glass sands. The Mid-Continent Glass Sand Company had the problem of removing small amounts of iron which had been allowable under previous specifications.

Concentrating tables were installed to remove the limonite. However, a small fraction of very fine iron, imbedded in the sand grains, could not be removed by gravity. Mid-Continent Glass Sand Company conducted research using a Denver "Sub-A" Continuous Laboratory Flotation Machine and on basis of the good results obtained installed an 8-cell No. 18 Special Denver "Sub-A" Flotation Machine to remove this iron.

In their present operation the flotation feed consists of approximately 19 tons dry sand per hour in a pulp of 33% solids. The sand is all minus 30 mesh and approximately 45% plus 100 mesh. The pit sands run .26% to .40% Fe_2O_3. Tabling reduces this to .065%. Treating this table product the flotation section reduces the Fe_2O_3 content to .03% which is well below the requirement for high grade flint, container and plate glass.

Selected Denver "Sub-A" Flotation

This is just one of the many cases where research by industrial and chemical companies, and by Denver Equipment Test Laboratory, has resulted in use of flotation for refinements in modern processing methods (such as on talc, coal, clay, fluorspar, phosphate, graphite, bauxite, barite, sulphur, salt, potash, rubber, and grain.) Mid-Continent Glass Sand Company, like other successful companies, selected Denver "Sub-A" Flotation to assure profitable results.

Use Deco Test Service

The Denver Equipment Company has specialized for many years in developing flotation processes and manufacturing flotation equipment. Complete batch and continuous test laboratories are maintained for research on flotation applications. Submit your problems to our experienced staff of Flotation Engineers . . . take advantage, now, of this test service. Write to any one of the Deco offices listed below.

STANDARD RELIABLE 24 HOUR SERVICE EFFICIENT

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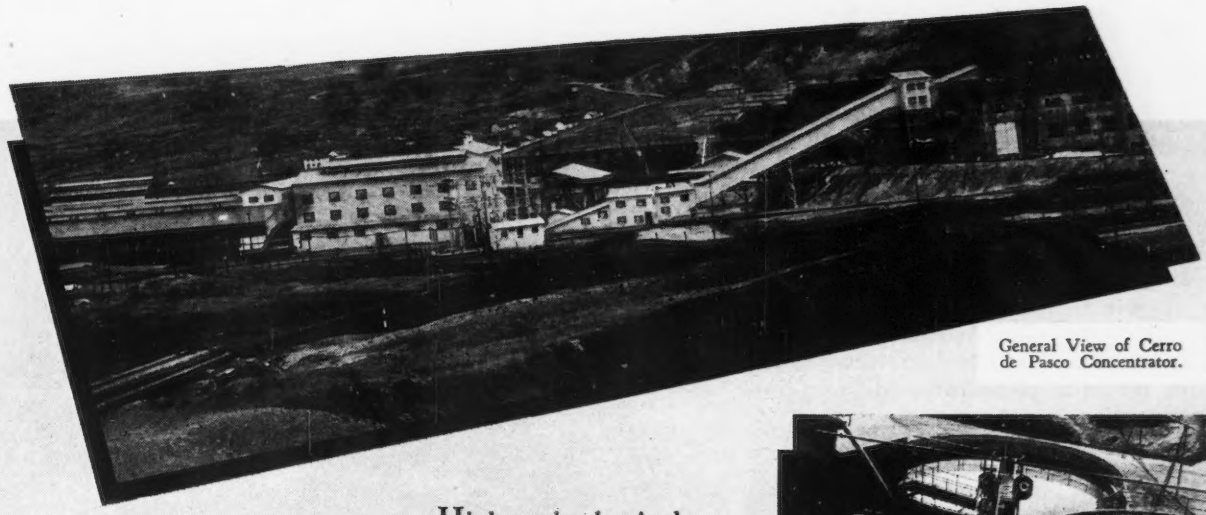
Cerro de Pasco Concentrators – Dorr Equipped

Let Dorr Engineers Study your needs right at the site



General View of Cerro de Pasco Concentrator.

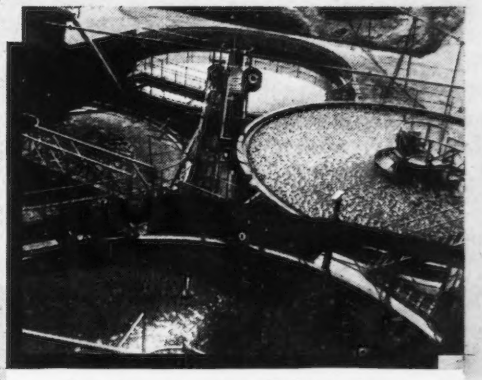
High up in the Andes or down at sea level, wherever there are rough-and-tough milling jobs to be done, you will find husky, ruggedly designed Dorr machines in the Concentrators. And behind this wide popularity of Dorr machines is the on-the-spot service of Dorr *engineers.*

The Cerro de Pasco Copper Corporation set up an office at Oroya, Peru, to design the new 800-ton "Concentrador" for its lead-zinc mine high up at Cerro de Pasco. Soon after the office opened, a Dorr metallurgical engineer was on hand at Oroya. He assisted with various phases of the milling problems. This Dorr service was extended to the Cerro de Pasco Corporation without obligation in any way.

The Dorr policy of having engineers on the job in its earliest phases, accounts, in large measure, for the ability of Dorr equipment to meet the diverse requirements in concentrators throughout the world.

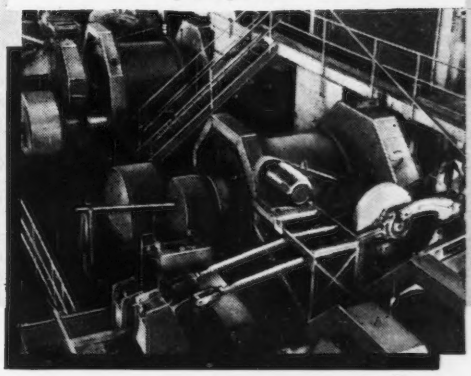
More and more Dorr engineers are now returning from the armed services and are becoming available to assist others as they did at Cerro de Pasco.

If you expect to build new concentrators, or to modernize old ones, make it a point to call in a Dorr engineer early in your planning.



Dorr Center Pier Torq Thickeners, heavy duty, Type SX

Dorr Closed Circuit Grinding System with Dorr-Scott Sand Wheels closing the primary grinding circuit.



In the new Cerro de Pasco Concentrator, all primary and secondary ball mills are closed-circuited with Dorr Heavy Duty FX Classifiers. All concentrate Thickeners are Dorr Center Pier Type SX. Underflow Control Pumps are Dorr Type VM. Dorr-Scott Sand Wheels close the primary grinding circuit. Dorr equipment also serves Cerro de Pasco Concentrators at Casapalca, Morococha, and Mahr Tunnel.

803

DORRCO

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ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE

RockerShovels

BUILT FOR BATTLE

Even though the battles of World War II have ended, the battle for production will continue so that industry may quickly restore the material needs of men in a peaceful world. RockerShovels are built for battle—the alloy steel castings that make up the sinews of a RockerShovel are made in Eimco's electric furnaces — from raw materials to finished products strictest supervision guarantees RockerShovel operators a trouble-free machine. Underground, the battle for production is not an easy one—the going is always tough, but every part of a RockerShovel has been built to take it —machined parts have been made on the most modern precision tools, every RockerShovel has been inspected and tested before it enters the battle of production.

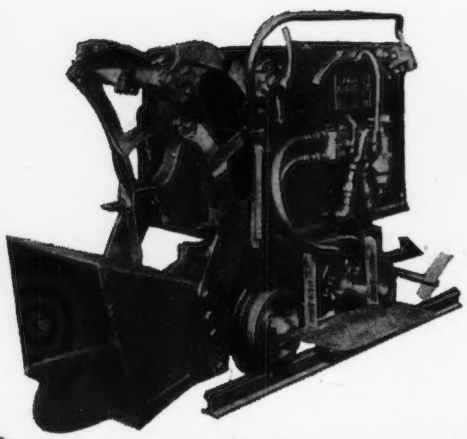
That's why RockerShovels operate continuously month after month, load more in less time, with maintenance costs that are lower than those of any competitive type of machine.

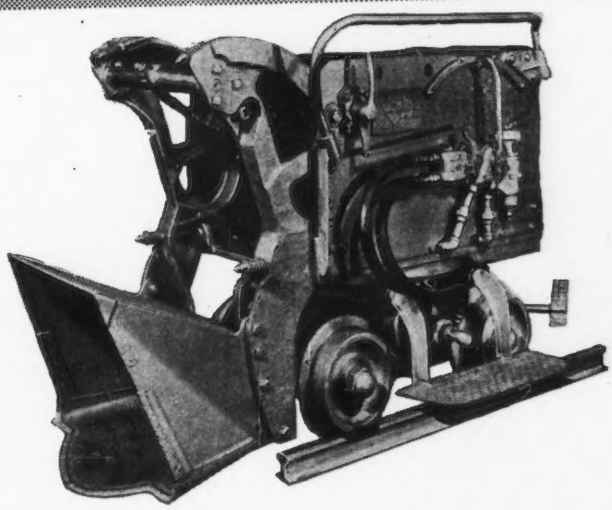
Eimco, the pioneer of rocker-arm loading equipment, is in position to give you authentic information on loading jobs. Your inquiries are invited.

Eimco RockerShovel

View showing electric furnace in Eimco's steel foundry. Steel castings for RockerShovel decks, gears, wheels, etc. are all made in this foundry.

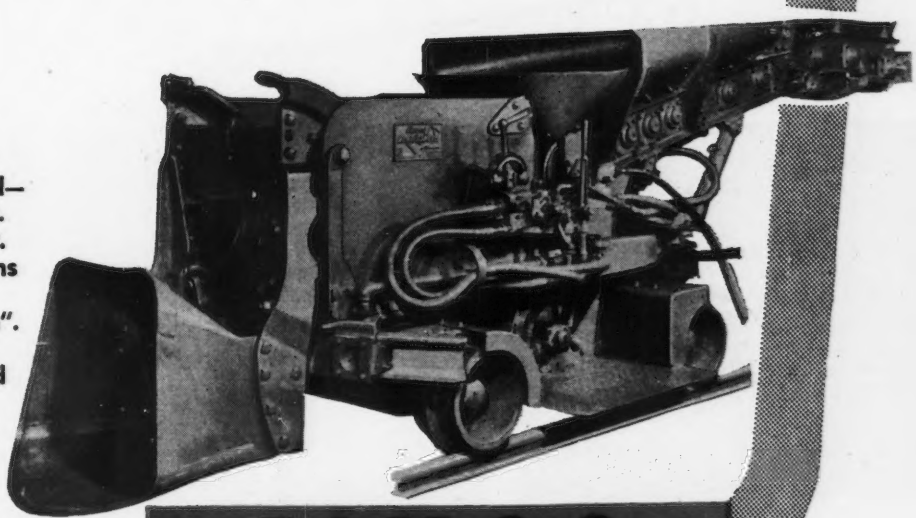
Model 12B RockerShovel—
Weight 4200 pounds.
Cleanup range 8 feet.
Loading speed 1—2 tons per minute.
Track gauge 15"—36"
Air powered models only.
Min. caging dimensions 28"x42".





Model 21 RockerShovel—
Weight 7200 pounds.
Cleanup range 10 feet.
Loading speed 2—3 tons per minute.
Track gauge 18"—48".
Air or electric powered models.
Min. caging dimensions 33½"x50".

Model 40 RockerShovel—
Weight 15,900 pounds.
Cleanup range 16 feet.
Loading speed 3—5 tons per minute.
Track gauge 30"—56½".
Power swing.
Air or electric powered models.



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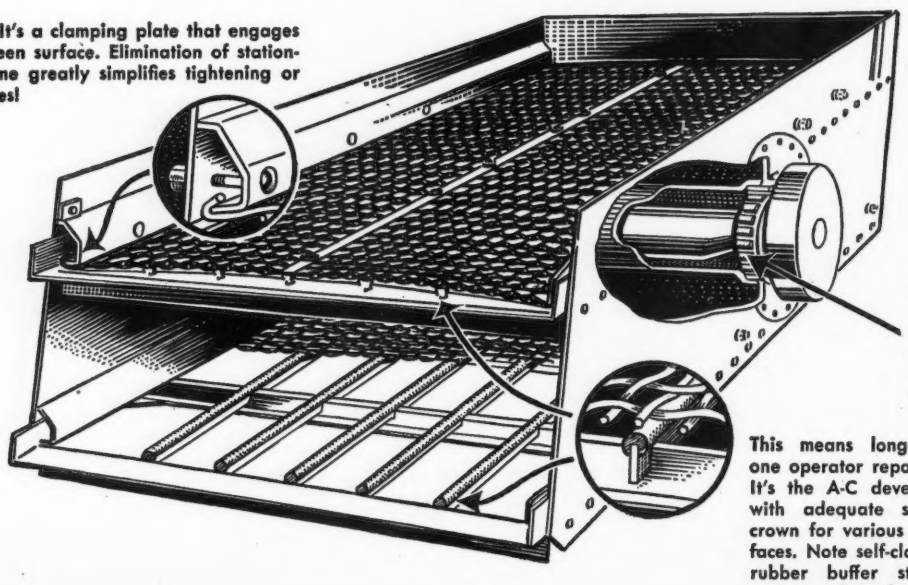
A104

"Low Cost--High Capacity!"

THAT'S THE STORY IN A NUTSHELL ABOUT AMERICA'S NO. 1 VIBRATING SCREEN--THE "RIPL-FLO"!

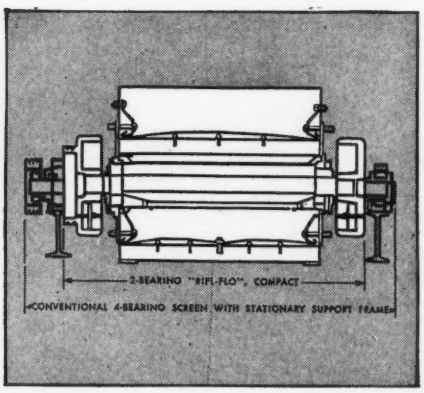
This saves time! It's a clamping plate that engages and tensions screen surface. Elimination of stationary support frame greatly simplifies tightening or changing surfaces!



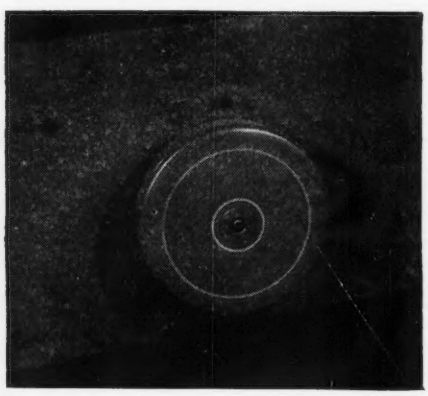
This means low initial cost, low power consumption, low maintenance! Only 2 bearings are required to impart perfect circle motion to screen surface and body!

This means longer wire cloth life—one operator reports up to double life! It's the A-C developed support frame with adequate strength and proper crown for various grades of screen surfaces. Note self-clamping, wear-resisting rubber buffer strips that "cushion" screen surface from frame.

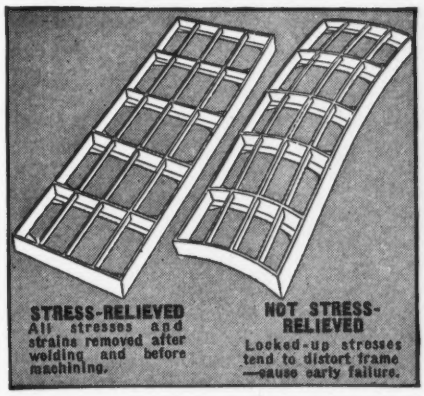
1 Fact is, 2-bearing "Ripl-Flo" *costs less* than any comparable 4-bearing screen—yet does as good *or better* screening job! One reason we can build it for less, pass savings to *you* is that . . .



2 Extra outer bearings, stationary support frame, *all* superfluous parts are eliminated — reducing width 17%, weight 36%! This, coupled with *perfect balance*, cuts amount of power required.



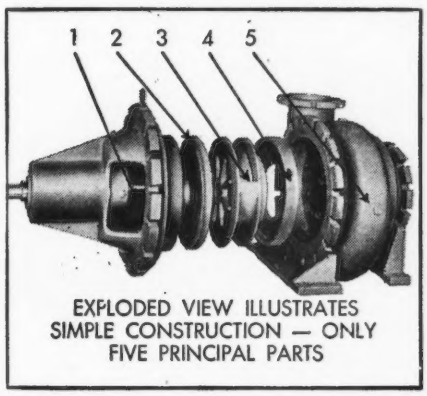
3 Yes, Ripl-Flo's perfectly balanced mechanism means *smooth* performance, *uniform travel* of material over entire surface, *rapid stratification* of bed, *full capacity!* Want *low* maintenance?


STRESS-RELIEVED
All stresses and strains removed after welding and before machining.
NOT STRESS-RELIEVED
Locked-up stresses tend to distort frame —cause early failure.

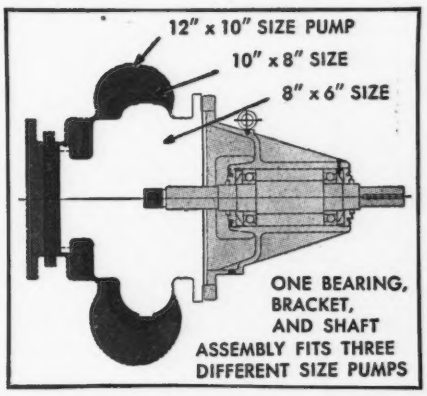
4 Screen body is high tensile strength alloy steel (up to *50% stronger* than regular steel). All welded parts are "stress-relieved" to *eliminate* structural failures—give *extra years* of screen life!

5 Before it can go out to do a job for you, every "Ripl-Flo" screen must pass a tough, 2 hour "exam." Running in a special test rig, it's checked for throw, balance, bearing temperature, etc.

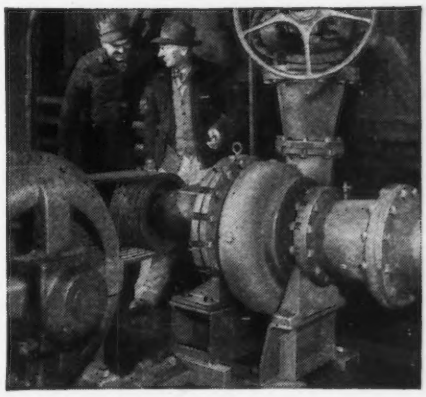
6 The customer gets his *choice* at A-C—can select from 8 *different* types of screens! Want more details on *modern, up-to-date* Ripl-Flo—1 to 4 decks? Send for Bulletin B6151B.



7 Another A-C help is the new "Solids-Handling" pump—that promises *2 to 4 times longer life*—cuts parts inventory *much as 2/3*—*materially* reduces downtime! It's so designed that . . .



8 You can remove entire rotating element *without* disturbing piping—take apart, re-assemble entire pump fast as ½ *hour!* And, it is comparable in price to ordinary high efficiency pumps.



9 Here's what one operator reports: "Downtime cut 400%; power savings $7 day; parts inventory cut 70%!" Want a *new low cost* per ton of solids pumped? Get Bulletin B6381.

GET THIS "TEAM-UP" FROM ONE SOURCE!

Equip your plant with *basic* machinery *plus* economical power equipment to *run* it—get it all from *1* company! Yes, A-C not only builds screens, crushers, grinding mills, kilns, etc.—but also power generation, distribution and control equipment—motors, pumps, blowers, compressors, Texrope V-Belt drives—*over 1600 different products for you!*

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PRODUCER OF WORLD'S LARGEST LINE OF CRUSHING, CEMENT & MINING EQUIPMENT!

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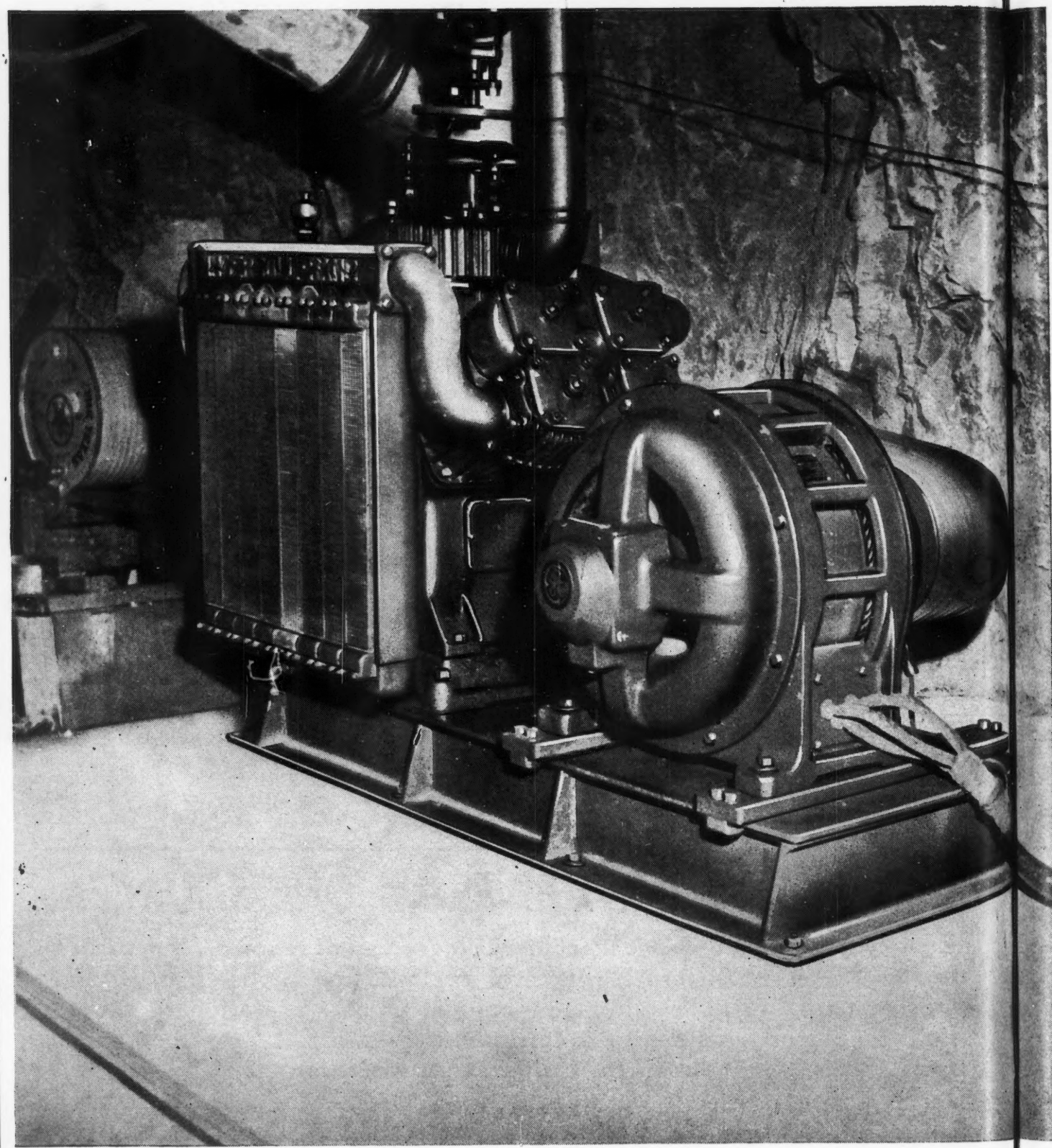


TEXACO

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS

VALVES CLEAN RINGS FREE PORTS OPEN

with compressor oils that don't form hard carbon deposits

GET these important benefits . . . assure fewer repairs and replacements, longer and more trouble-free service between overhauls, better performance at lower cost . . . by lubricating your air compressor with *Texaco Alcaid, Algol or Ursa Oils.*

Texaco Alcaid, Algol and Ursa Oils are products born of many years of intensive research by The Texas Company in the field of air compressor lubrication. They are made from carefully selected crudes. The lubricating fractions are processed by modern Texaco methods in one of the world's largest refineries under the constant supervision of trained Texaco technicians. This is your assurance of uniformly high quality no matter where you buy them.

Because of the many benefits it delivers—

More copper mining equipment in the U. S. is lubricated with Texaco than with any other brand.

Texaco Products and Lubrication Engineering Service are available through more than 2300 Texaco distributing plants in the 48 States. Contact the nearest one, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

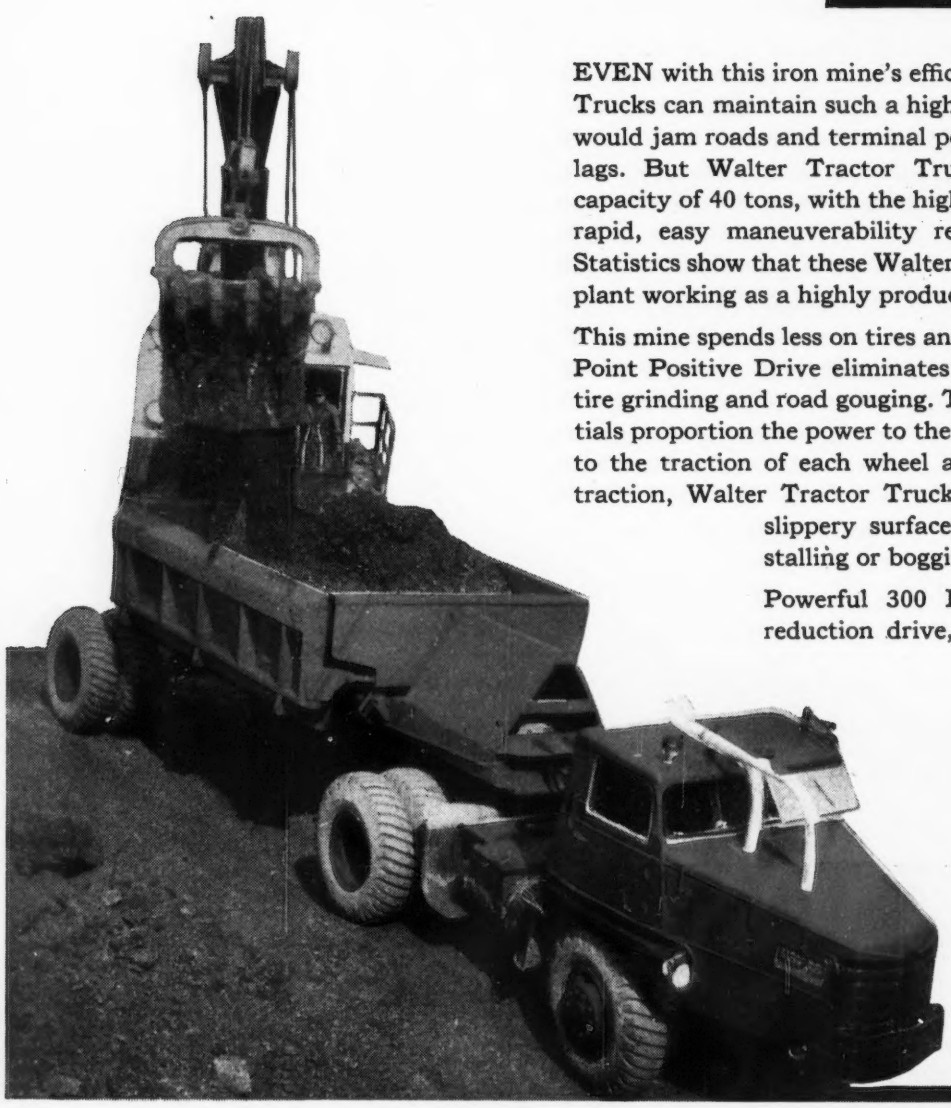
FOR THE MINING INDUSTRY

METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

9,000 TONS EVERY EIGHT HOURS

at a SINGLE DUMPING POINT

DAILY AVERAGE with WALTER TRACTOR TRUCKS



EVEN with this iron mine's efficient set-up, only Walter Tractor Trucks can maintain such a high production rate. Smaller trucks would jam roads and terminal points. Slower trucks would cause lags. But Walter Tractor Trucks combine the big payload capacity of 40 tons, with the high speed, quick side-dumping and rapid, easy maneuverability required for adequate headway. Statistics show that these Walter Tractor Trucks keep shovel and plant working as a highly productive team.

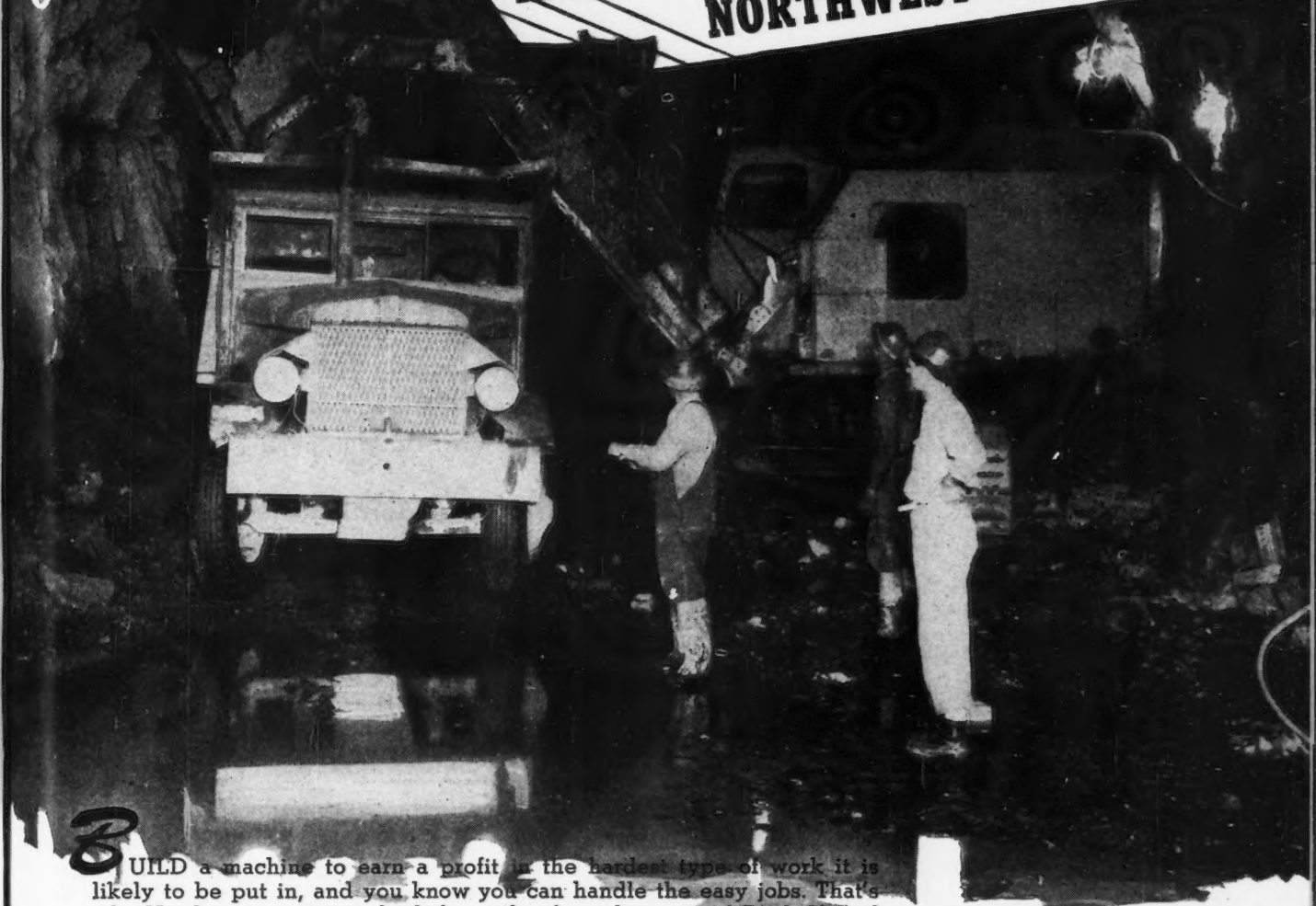
This mine spends less on tires and roads because the Walter Four Point Positive Drive eliminates the wheel spinning that causes tire grinding and road gouging. Three automatic locking differentials proportion the power to the FOUR driving wheels according to the traction of each wheel at any instant. With this 100% traction, Walter Tractor Trucks haul through soft dirt, mud, slippery surfaces and up steep grades without stalling or bogging down.

Powerful 300 H.P. motor, suspended double reduction drive, tractor type transmission, hydraulic steering, and powerful air brakes are among the other features, all completely described in our illustrated folder. Write for it.

WALTER MOTOR TRUCK CO.
1001-19 IRVING AVE.
RIDGEWOOD 27,
QUEENS, L. I., N. Y.

Another Northwest in ROCK!

DIGGING THE PROFITS OUT OF THE FUTURE IS GOING TO TAKE THE KIND OF EQUIPMENT NORTHWEST BUILDS!



BUILD a machine to earn a profit in the hardest type of work it is likely to be put in, and you know you can handle the easy jobs. That's why Northwest engineers built for rock—if you have a real Rock Shovel you'll never have to worry about any other type of digging.

With the Northwest "Feather-Touch" Clutch Control for easy operation, the Northwest Dual Independent Crowd that utilizes force other shovels waste, the Northwest Welded Shovel Boom (and no Northwest welded shovel boom has ever failed), the Cushion Clutch that increases both cable and machine life, the Uniform Pressure Swing Clutches that eliminate the machine torturing jerks and grabs of ordinary band type swing clutches, you are equipped for any type of digging at the lowest possible cost per yard. It is the most up-to-the-minute piece of equipment in the field—for tomorrow!

Let us send you details on the size and type machine you are interested in to help you in your postwar plans.

NORTHWEST ENGINEERING CO
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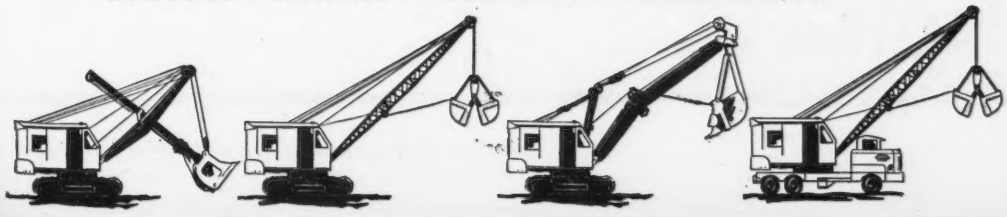
INDEPENDENT CROWD plus AUTOMATIC CROWD
FOR GREATER DIGGING POWER
The DUAL CROWD

NORTHWEST

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS



If you have a real Rock Shovel you never have to worry about output in dirt.

USE the Haulage BATTERY with these Cost-Cutting Advantages

These inherent construction and operating advantages are principal reasons why Edison Alkaline Batteries provide the closest approach to failure-free uninterrupted haulage power it is possible to obtain; give longer service life than other types of batteries; are so simple to maintain, and consequently, so economical to use. Because of their unequaled dependability and long, trouble-free life, alkaline batteries are helping users to keep down haulage costs. *Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, N. J.*

In Mine Locomotives and Shuttle Cars, Only Edison Alkaline Batteries Give You These Important Advantages:

- They are **durable mechanically;** grids, containers and other structural parts of the cells are of steel; the alkaline electrolyte is a preservative of steel.
- They are **foolproof electrically;** are not injured by short circuiting, reverse charging or similar accidents; are free from self-deteriorating reactions.
- They are **simple and easy to maintain.**
- They can be **charged rapidly;** do not require critical adjustment of charge rates; can be charged directly from mine d-c supply.
- They **withstand temperature extremes;** are free from freezing hazard; are easily ventilated for rapid cooling.
- They can **stand idle indefinitely** without injury, without attention, and without expense.

Edison

ALKALINE BATTERIES

THE *125* CONWAY SHOVEL

FOR ROCK GANGWAYS—
DRIFTS—SMALL BORE TUNNELS

Speed • Range • Capacity that's what the 125 gives you. SPEED to step-up your rate of advance; RANGE to allow you good cleanup on both sides and below the rails, in corners and around timbers; CAPACITY to handle all materials, blocky or fine, wet or dry.

Can we give you complete details?

14137

Track stability and the pick-up of all fly rock are other advantages of the 125.

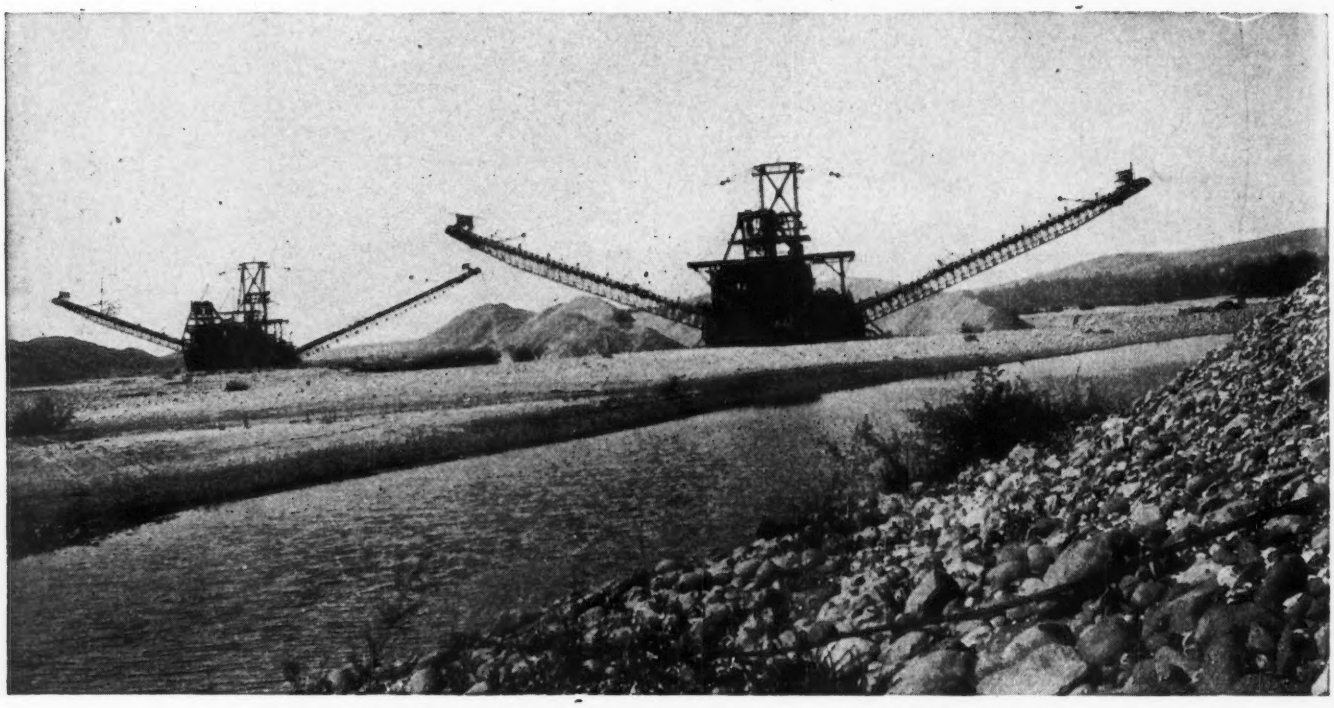
GOODMAN MANUFACTURING COMPANY

HALSTED STREET AT 48TH • CHICAGO 9, ILLINOIS

Locomotives • Loaders • Cutting Machines • Conveyors

Placer Dredge Parts

— by Yuba



Yuba double stacker dredges at Hammonton, California—digging flood control channels for U. S. Army Engineers during gold dredging operations.

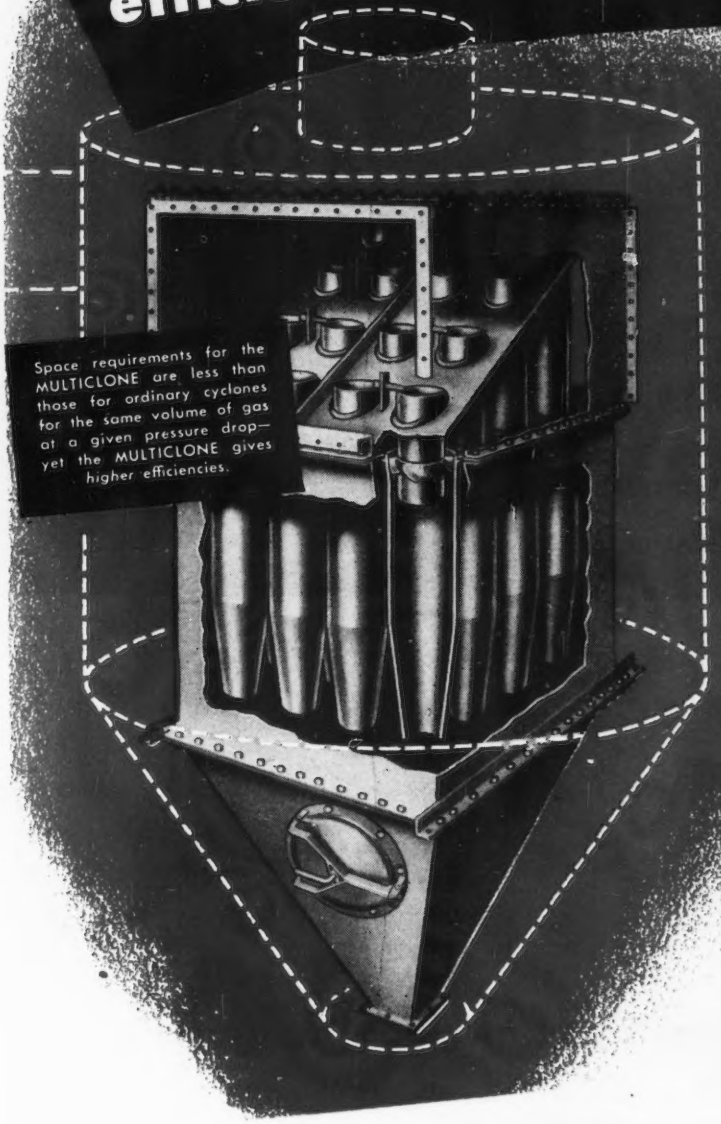
Yuba's wartime job, building 155 mm howitzers for the Army, is now history. The full facilities of its engineering staff and plant are available for building placer mining dredges and parts. Yuba dredges are used throughout the world for mining gold, platinum, tin, and other mineral products. Dredges are not a side line with Yuba. If your dredge was built by Yuba or if Yuba furnished parts in the past, a complete record is in our San Francisco engineering files. A letter or cable referring to your old order will bring a quotation for duplicate parts. Quotations will be made promptly after receipt of drawings or specifications.

Look over this partial list of Yuba placer dredge parts; perhaps your operating reserve stock is low. Continuous production, by your dredge, depends upon an adequate supply of spare parts; rush orders, after a breakdown, are costly because of the lost yardage and can be avoided by having spares on hand.

REVOLVING SCREENS
TIMANG WELDING RODS
SCREEN BOLTS — PIPING
RIFFLES — JIGS — TABLES
SCREEN RINGS and BOLTS
LOWER TUMBLER BEARINGS
WIRE ROPE and FITTINGS
BOLTS for WEARING PLATES
LOWER TUMBLERS and SHAFTS
STACKERS and STACKER BELTS
LIP BOLTS — PIN WEDGE BOLTS
LADDER ROLLERS and BEARINGS
HULL PONTOONS, portable type
CASTINGS — FORGINGS — CLUTCHES
PUMPS, high and low pressure
POWER UNITS — ELECTRICAL PARTS
WINCHES, ladder hoist or swing
CONTROL UNITS —DEPTH RECORDERS
STEEL HULLS and SUPERSTRUCTURE
SCREEN PLATES, ARS wear resisting
UPPER TUMBLERS and WEARING PLATES
BUCKETS and LIPS, manganese steel
USS ABRASION RESISTING STEEL PLATE
BUCKET PINS, heat treated alloy steels

YUBA MANUFACTURING CO.
351 California St., San Francisco 4, California, U.S.A.
AGENTS: Alluvial Dredges, Ltd., Renfrew, Scotland; London, England—Sime, Darby & Co., Ltd.
CABLES: Yubaman, San Francisco—Yardage, London

Why low pressure drop gets greater efficiency in the MULTICLONE!



Space requirements for the MULTICLONE are less than those for ordinary cyclones for the same volume of gas at a given pressure drop—yet the MULTICLONE gives higher efficiencies.

IT IS an engineering fact that the smaller the radius of the collecting tube in a mechanical dust separator, the greater the centrifugal force exerted for the same pressure drop.

The patented vane of the MULTICLONE permits the bunching of many small-diameter collecting tubes with a single inlet and outlet header without increasing the pressure drop.

THE RESULT:

1. High collection efficiencies...
2. More compact construction, requiring a minimum of space

—at the *same* pressure drop required by the common large cyclone for the same volume of gas treated.

The sharper curvature of the small-diameter MULTICLONE collecting tubes produces higher centrifugal force at a given pressure drop than is the case in larger tubes, and throws out from the gas stream a high percentage of the hard-to-recover "fines" as well as the coarser particles. Result: MULTICLONE *recovery efficiencies are high even in the small particle sizes of 10 microns and less.*

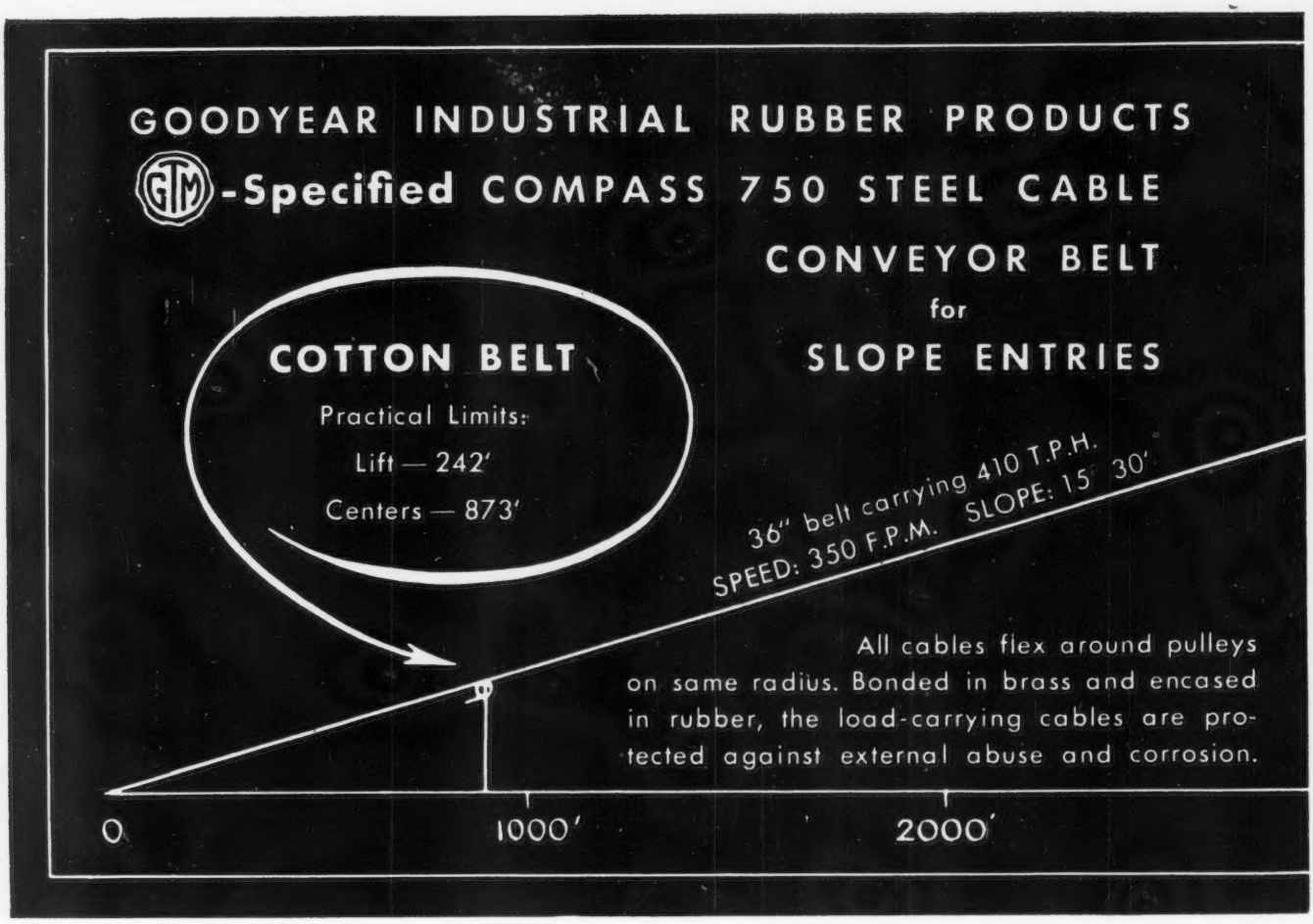
Literature available on request gives full details.

Besides high recovery efficiencies at low pressure drop, there are many other MULTICLONE advantages. Before you purchase any recovery equipment, let one of our sales engineers give you the complete MULTICLONE story. A letter, wire or phone call places this information on your desk without obligation.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1012 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 LaSALLE ST. BLDG., 1 N. La SALLE ST., CHICAGO 2 • HOBART BUILDING, SAN FRANCISCO 4, CALIFORNIA
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL


GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM-Specified COMPASS 750 STEEL CABLE
CONVEYOR BELT
for
SLOPE ENTRIES
COTTON BELT
Practical Limits:
Lift — 242′
Centers — 873′
36″ belt carrying 410 T.P.H.
SPEED: 350 F.P.M. SLOPE: 15° 30′
All cables flex around pulleys on same radius. Bonded in brass and encased in rubber, the load-carrying cables are protected against external abuse and corrosion.
0
1000′
2000′

Now comes the STEEL CABLE conveyor belt

with revolutionary advantages in slope haulage!

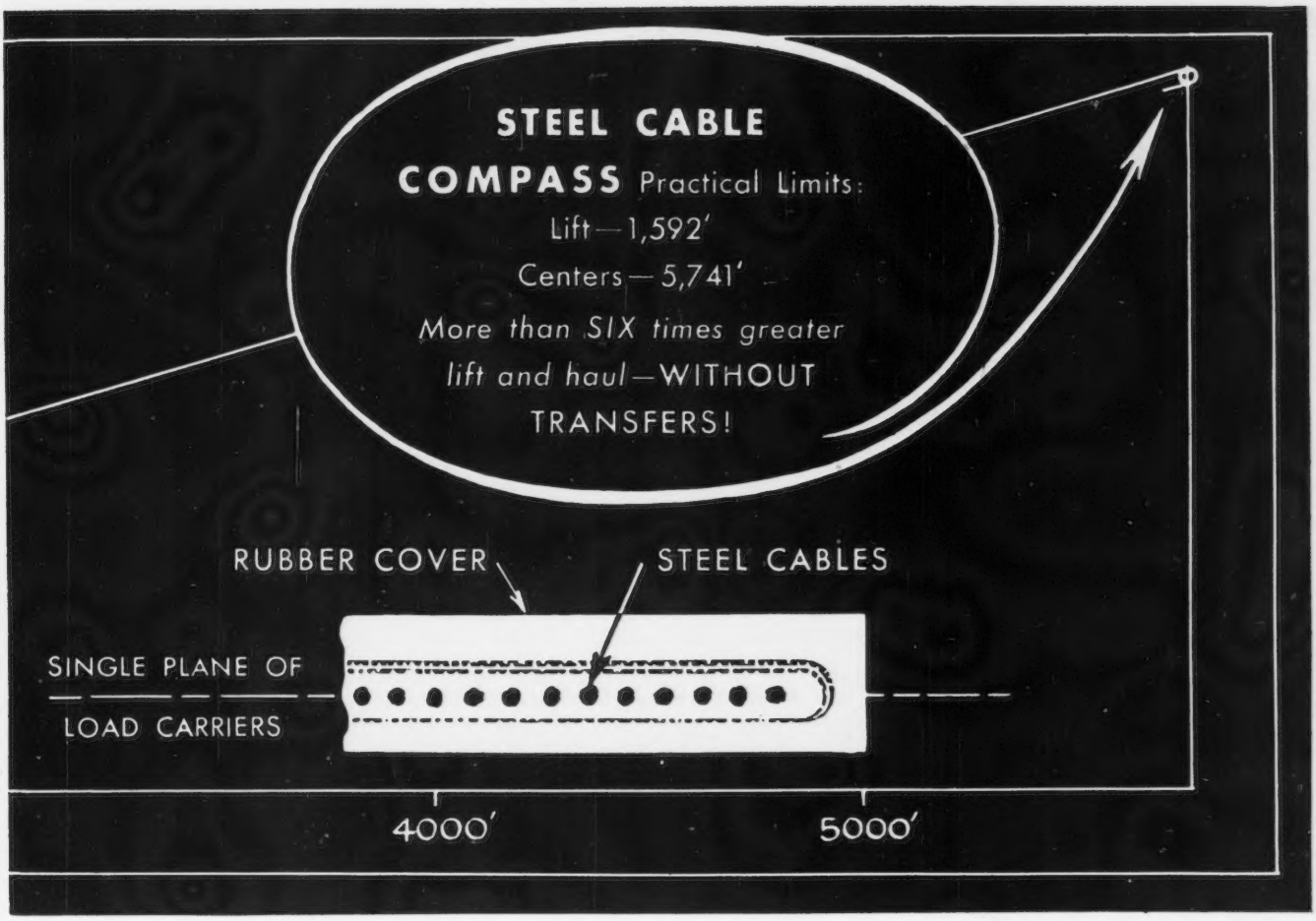
THE well-known economies of slope conveyor belts as escape from underground and deep pit mines are now further multiplied by a revolutionary new Goodyear transportation development — the **Compass** *Steel Cable Conveyor Belt.*

As its name implies, this new Goodyear rubber-covered belt is bodied with finely stranded, airplane-type steel cables having enormously greater strength and tension capacity than any belt of cotton cord or fabric construction.

What this means, operation-wise, is shown by the blueprint above. The new Goodyear Steel Cable **Compass** makes it possible to handle lifts as great as 1,592 feet with a single belt operating on mile centers — *more than SIX times greater lift and haul than practical with any present belt!*

NO TRANSFERS

As a result, the great majority of slope entries can now be belted with ONE Goodyear Steel Cable



Compass running from mine level to tipple — instead of the two, three or more belts required in current practice. Thus all belt transfers along the slope are eliminated, making it possible to carry much larger lumps, without breakage or degradation.

Further, **Compass'** high strength permits operation at slow enough speeds F.P.M. for optimum cross-section loading, assuring good nesting for large lumps — no tumbling or roll back. Slower speed also gives uniform, continuous, high-tonnage delivery at tipple — reduces idler wear and maintenance — insures longer belt life.

To get the full story of this "super" belt and its many other economies, consult the G.T.M. — Goodyear Technical Man — before rebelting present mines, or opening new workings. Write: Goodyear, Akron 16, Ohio or Los Angeles 54, California.

• • •

FOR HOSE, BELTING, MOLDED GOODS, PACKING built to the world's highest quality standard, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

Western

DROP-DOOR TRAIL CARS . . . .

The Austin-Western Side Dump, Drop Door Trail Car is designed and constructed throughout for loading ore and stone, and similar heavy service.

The body has strong side sills and closely-spaced cross sills, all welded together as one unit. The underframe has four longitudinal sills, with top and bottom cover plate, and cross sill reinforcement.

The Dump Cylinders are located in the center of the underframe, thus utilizing a short stroke cylinder and permitting faster dumping and righting of the body, and quick get-away. The direction of dumping is controlled by a lever in the cab of the truck.

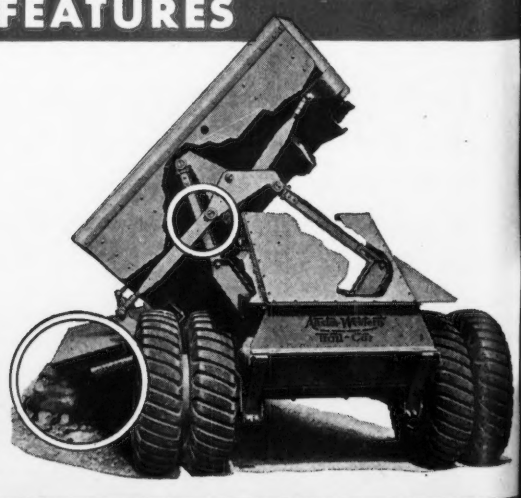
The Austin-Western Trail Car remains stable under the most severe dumping conditions, there being absolutely no tendency to lift the wheels when dumping.

It's for such reasons as these that the "Western" Drop Door Trail Car is preferred for all-around service by leading operators. For special service, the A-W Line also includes Hopper-Bottom and Tray-Type Trail Cars. Our Engineering Department will be glad to recommend the particular type best suited to your requirements.

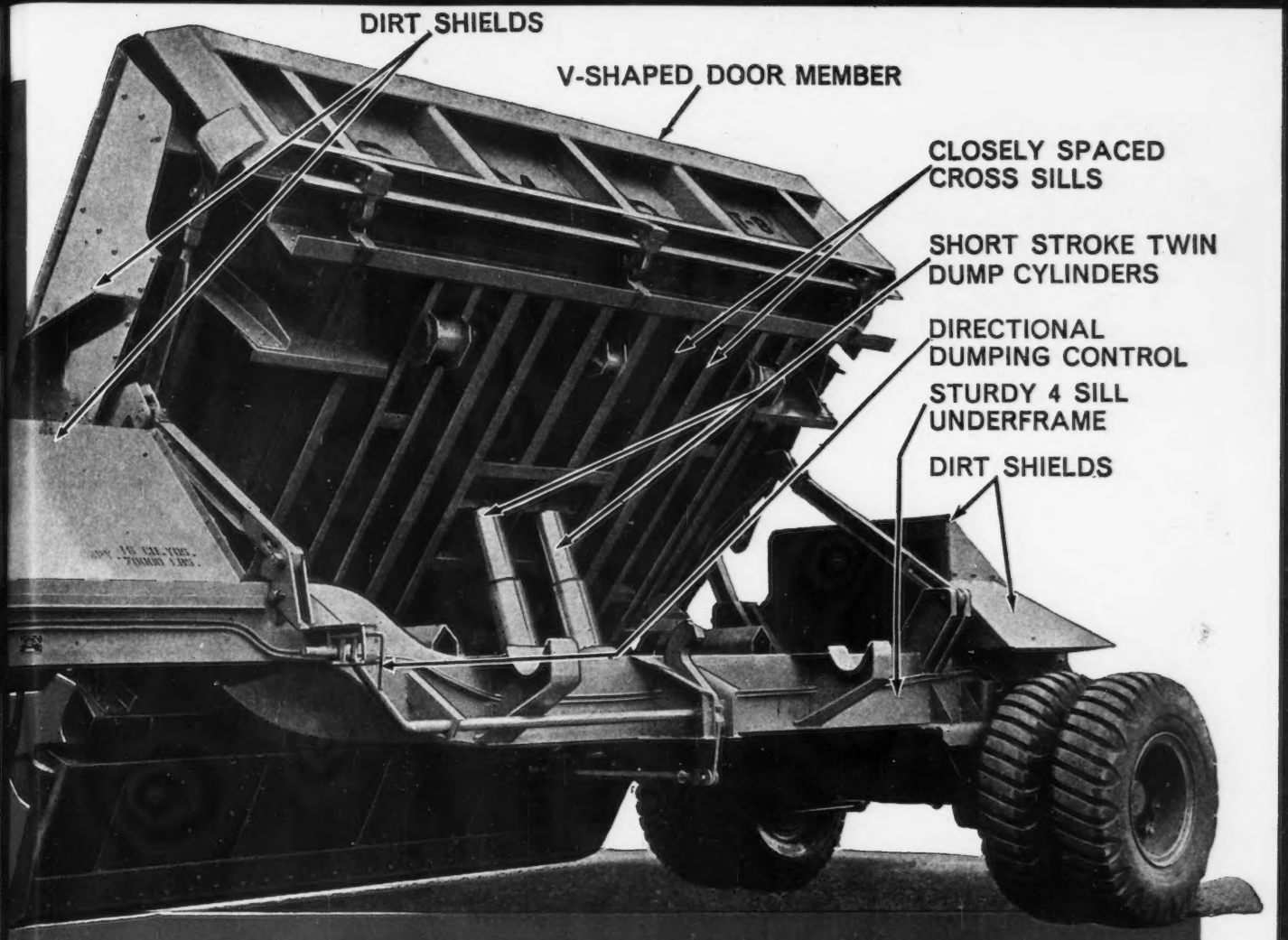
DOOR CONTROL . . . . SAFETY FEATURES

The Patented Austin-Western Door Control is of the floating type; located at each end of the body, and consisting of simple levers and bell cranks. This door control is 100% efficient, and automatic in its operation during the dumping and righting of the body, which is controlled by a hydraulic valve located in the cab of the truck. The mechanism, shown in the cutaway photograph below, is fully protected by cover plates, and provided with means to grease the moveable parts.

—WIDE BASE FOR SAFE DUMPING—

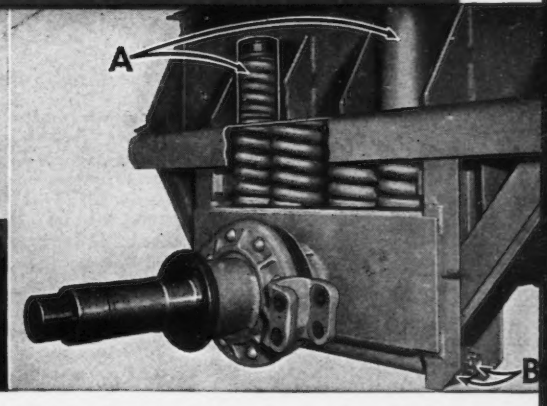


This floating type door control permits the body to be dumped to the full dumped position, and the door to strike an obstruction and remain stationary without damage to either door or body. Normal operation is shown in the photograph above and at the left; the slot in the door control arm is clearly shown. Should the door strike an obstruction in dumping, as in the photograph at the right, the slotted arm permits the door to "float" on top of the object it strikes.



LEAD IN PERFORMANCE FEATURES

Western" 16-yard level full, 35-ton capacity, two-way side dump, drop door, hydraulically erated Trail Car in stripping service at the Webb Mine on the Mesabi Iron Range. Unlimited scharge makes possible the handling of the large rocks and chunks seen in the picture.



This specially designed spring suspension with its two rebound snubbers ("A") on each side, prevents swaying of the body under load or empty. Springs are easily removed by loosening two rods and nuts ("B").

World's Largest Manufacturer of Dump and Trail-Cars

AUSTIN-WESTERN COMPANY

(Formerly the Western Wheeled Scraper Company)

AURORA, ILLINOIS • CABLE ADDRESS: AWCO, AURORA

Austin-Western also builds Power Graders, Rollers, Shovels and Cranes, Street Sweepers and a complete line of Rock Crushing and Screening Plants and kindred equipment.

Rubs

4 ARRANGEMENTS OF G-E SINGLE-CIRCUIT SUBSTATIONS

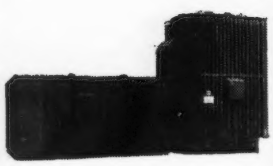
Arranged for overhead incoming and outgoing circuits. Simple, permits high portability.

Incoming circuit is overhead, and underground cable is used for outgoing circuit.

Both incoming and outgoing circuits are underground. Offer full protection against weather.

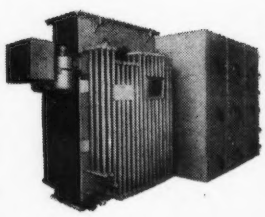
Arranged for both incoming and outgoing circuits to be underground, with a disconnect switch to isolate the unit from the incoming circuit.

There's a G-E Unit Substation for Every Mine and Preparation-plant Requirement



OUTDOOR MASTER UNIT

A complete master unit substation for multifeeder power systems, in either radial or network arrangements. Available in sizes from 750 kva to 25,000 kva for primary voltages up to 132,000 volts, and secondary voltages of 2,400 to 15,000 volts.

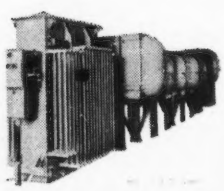


LOAD-CENTER UNIT

A compact substation for use close to 208Y/120- and 480-volt load-center areas supplied from 2400- to 15,000-volt sources. Adaptable to every low-voltage power requirement in preparation and extraction plants. Available in capacities from 100 to 2000 kva, indoor or outdoor use.

CONTROL-CENTER UNIT

When it is necessary to supply and control 220- to 440-volt motor branch circuits in a mine conveyor system, for example, this substation can be used. Adaptable to power sources from 2400- to 15,000-volts.



UNITS FOR SEMIHAZARDOUS LOCATIONS

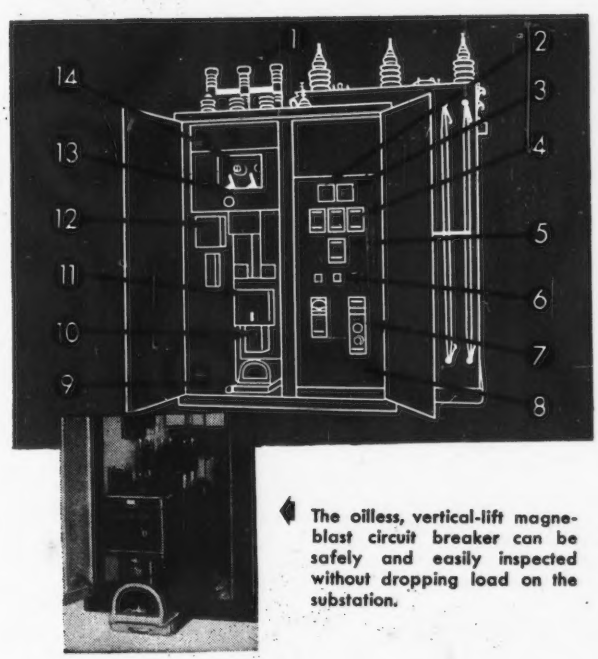
These unit substations feature completely metal-enclosed equipment with explosion-proof enclosures for low-voltage feeder breakers. (Class I, Group D construction.) May be used where semihazardous working conditions exist.

Keep on buying BONDS—*and keep all you buy*

GENERAL ELECTRIC

657-49-204

out risk...



The oilless, vertical-lift magne-blast circuit breaker can be safely and easily inspected without dropping load on the substation.

Principal components of a G-E SINGLE-CIRCUIT, INTEGRAL-TYPE UNIT SUBSTATION

1. Lightning arresters
2. Ammeter
3. Voltmeter
4. Drawout-type, induction overload relays
5. Drawout-type ground relay
6. Breaker control switch
7. Drawout-type reclosing relay
8. Hinged control panel
9. Drawout inspection tray
10. Breaker operating mechanism
11. 5-kv, 50,000-kva vertical-lift, magne-blast circuit breaker
12. Rectifier for breaker closing
13. Interlocked socket for by-pass switch handle
14. By-pass disconnect switch

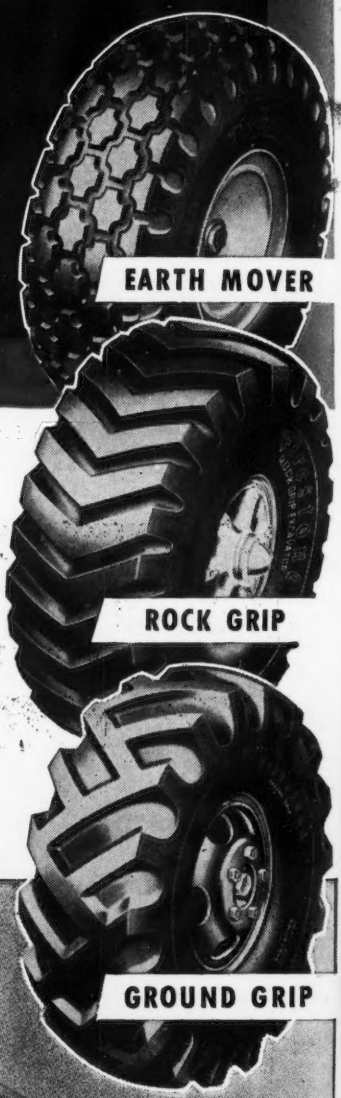
This new G-E unit substation protects your operators against fatal shocks from open-pit mining machines, yet doesn't "kick out" needlessly.

Here's a new integral-type unit substation that's a "natural" for open-pit mining. It is compact. It is readily portable. Best of all, it can be furnished with highly sensitive relays that detect those dangerous electrical faults which ordinary breakers miss (when power shovels and other mining machines are poorly grounded).

These relays, and the grounding system used in this unit substation represent the best protection G-E design engineers know how to give against electrical shock hazards. They are also your best assurance of operating continuity. For this substation is not an "alarmist." Breakers will not kick out because of harmless overloads or faults.

HIGHLY PORTABLE—The G-E integral-type unit substation is mounted on a single base. As mining operations advance, it's a simple matter to move the substation. You avoid excessive voltage drops and keep your machines running at full capacity. For a complete description, write for Bulletin GEA-4300. Whether for open-pit mines, underground mines, or concentrating plants, G.E. has the substation you need. With an eye to lower operating costs in the coming competitive era, it will pay you to review your present power distribution system with a G-E sales engineer. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Firestone TIRES- *Built for* TOUGH JOBS!



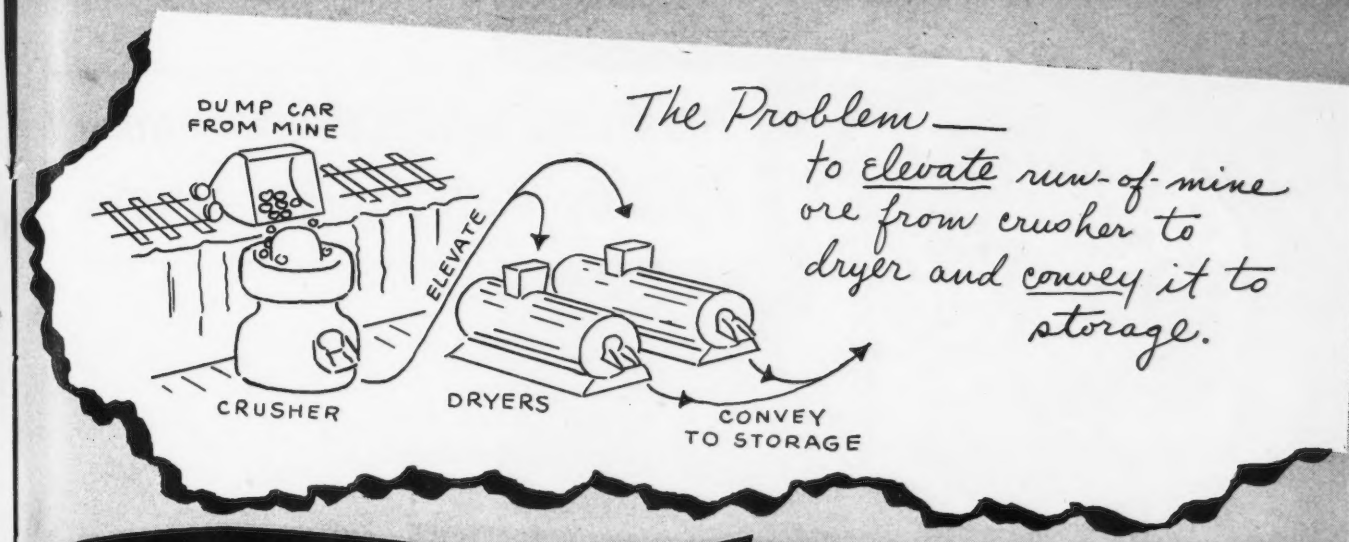
FIRESTONE Off-the-Highway tires are built to absorb the punishment of your toughest jobs. They're made to stay on the job longer with less time out for repairs.

Tread rubber on Firestone Off-the-Highway tires is tough . . . cut-resistant. Sidewalls are double-thick...a real protection against rutwear and snags. Four extra tread plies cushion and absorb impact blows. Cord bodies are made from the strongest rayon, Gum-Dipped for multiple strength.

Put Firestone Off-the-Highway tires on your equipment. Then watch your records. They'll tell a story of lowered costs and rising profits . . . proof of a good investment.

Listen to the "Voice of Firestone" every Monday evening over NBC network.

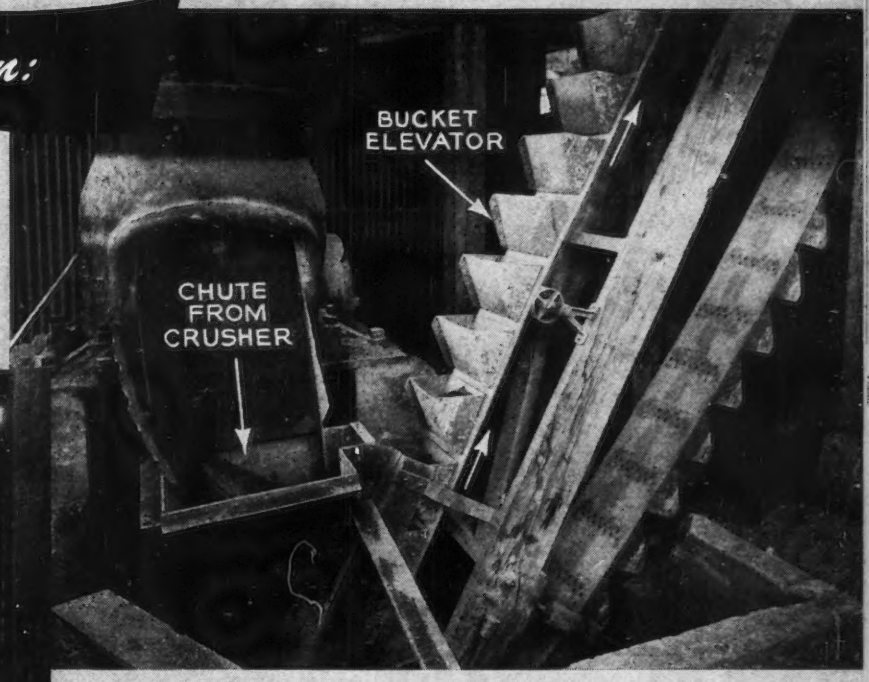
Copyright, 1945, The Firestone Tire & Rubber Co.



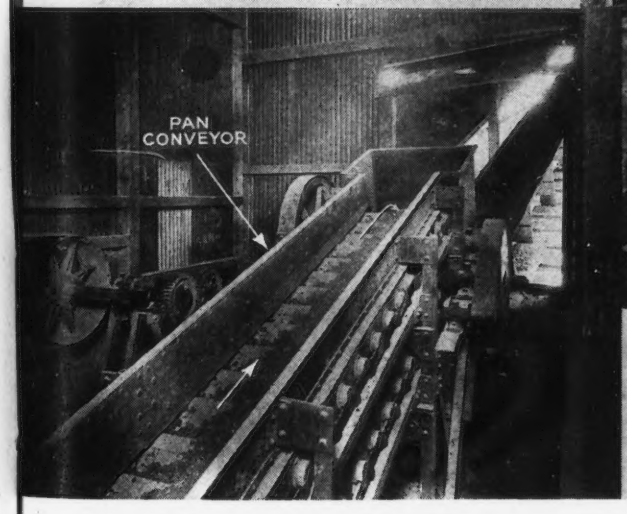
The Problem—
to elevate run-of-mine ore from crusher to dryer and convey it to storage.

the S-A Solution:

A Smooth Flow of Ore from Crusher to Storage



The discharge chute from the Crusher feeds the crushed ore into the loading leg of the Elevator as the buckets ascend from tail pulley. Ore is elevated to Dryers.



Here is the inclined run of the Pan Conveyor as it moves the ore from Dryers to storage. The Conveyor is fitted with skirt boards to prevent spillage.

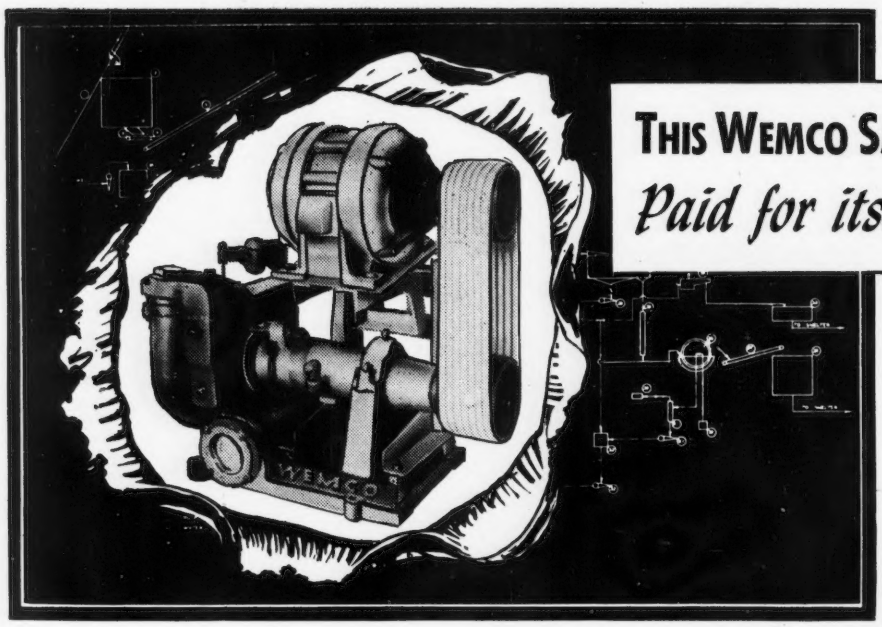
This plant was seeking an efficient way to move ore from Crusher to Dryer Feed Hoppers, and thence to storage. The combination installed here was S-A's low-cost solution. Two separate material handling units, an S-A Elevator and Pan Conveyor, were integrated into one complete, smooth-running system, which assures a free unobstructed flow of ore from the time it enters the plant in side-dump cars until, in crushed and dried form, it is finally dispatched to storage.

Here is another noteworthy example of how qualified S-A engineering plus dependable S-A equipment represent the most competent combination to lick tough handling problems.

STEPHEN S-A ADAMSON MFG. CO.

4 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT



THIS WEMCO SAND PUMP INSTALLATION
Paid for itself in three months

***Used for stockpiling sand, Wemco Sand Pump saves Southern California sand and gravel producer* 3c per ton.**

Wemco engineers solved the problem of a Southern California sand and gravel producer who was faced with the necessity for stockpiling the major portion of the sand yield from a pit producing one ton of sand for every two tons of gravel.

His old method of stockpiling with conveyor belt and bulldozer proved prohibitively expensive. To remedy this, a 6-inch Wemco Sand Pump with discharge line made up of 600 feet of 10-inch pipe was installed.

This installation handled *80 to 120 tons per hour* of minus 6 mesh sand in pulp with *900 gpm* water content, discharging into the stockpile area from a height of 20 feet. From time to time the discharge line was shifted, or pipe added, to form new piles.

Because of the ability of the Wemco Sand Pump to handle dense abrasive pulps, surprisingly little segregation of sand sizes occurred.

An analysis of operating costs reveals a saving of about 3c per ton by the installation. This 6-inch Wemco Sand Pump installation paid for itself in three months—and it is still going strong!

Economical and efficient solving of problems concerning the conveyance of abrasive pulps, slimes, and slurries is constantly achieved by Western Machinery Company engineers. We will be glad to make recommendations for your pumping problem.

Our bulletin, "Sand Pumps and Parts," contains a data sheet, general specifications on Wemco Pumps, and helpful hydraulic information. It presents in detail the reasons why Wemco Sand Pump construction can deliver savings to you. Copies are available on request.

1021

WEMCO

WESTERN MACHINERY COMPANY

760 FOLSOM STREET, SAN FRANCISCO 7, CALIFORNIA

LOS ANGELES • SACRAMENTO • SPOKANE • SALT LAKE CITY • PHOENIX • DENVER • NEW YORK • WASHINGTON, D.C.

AGITATORS • SAND AND DIAPHRAGM PUMPS • FEEDERS • CLASSIFIERS
HYDROSEPARATORS • THICKENERS • TABLES • H M S EQUIPMENT

The men behind the DRILLS Prefer TIMKEN BITS

Photograph courtesy Miami Copper Company, Miami, Arizona.

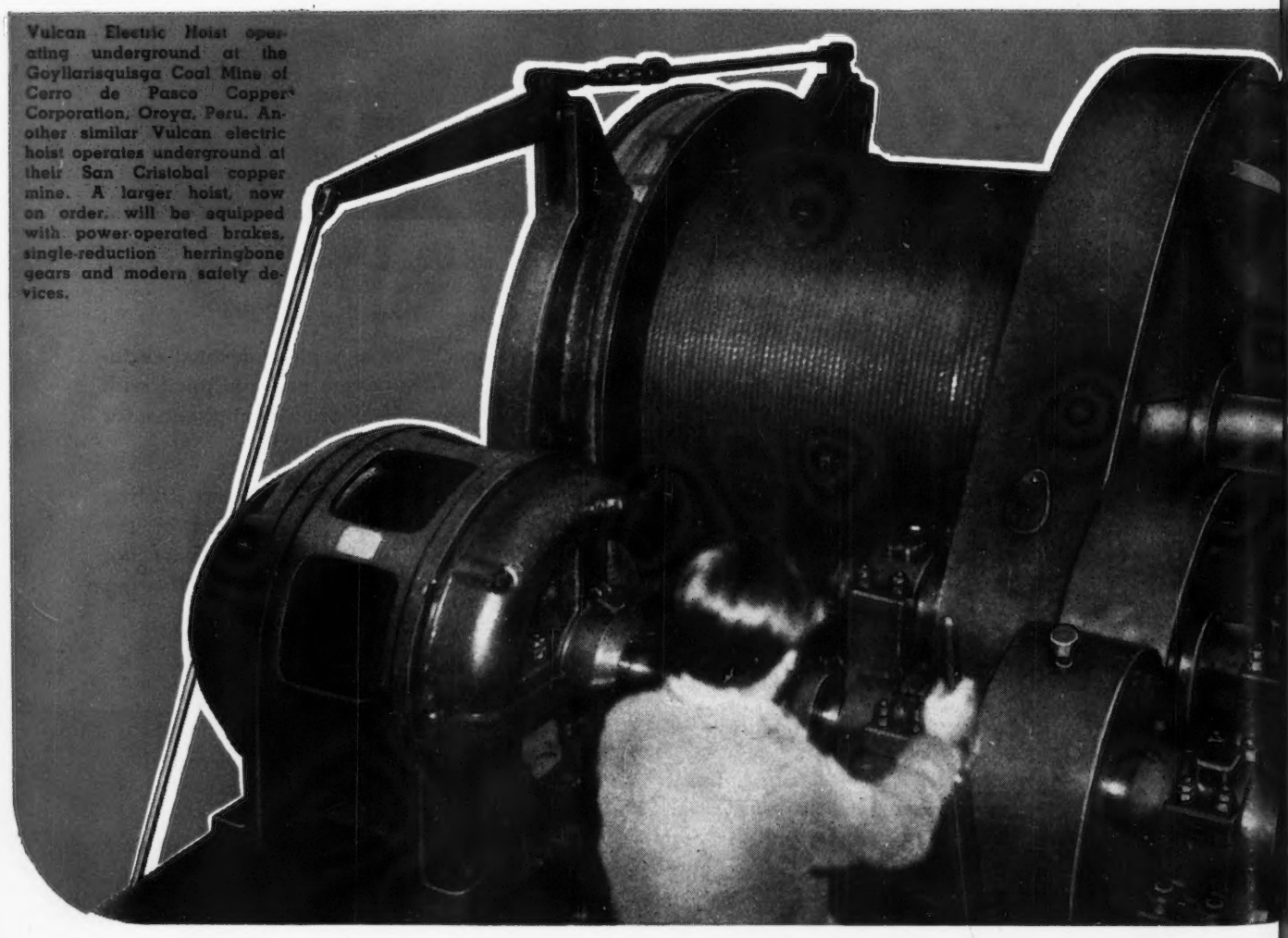
Drillers who are fortunate enough to have the advantage of Timken Removable Rock Bits—and that goes for a very large and constantly increasing number—are enthusiastic about them. They have found they can drill more holes per shift with much less effort and trouble than they ever were able to do with conventional steels.

This is reflected in lowered costs for the mine operators due to saving in steel; virtual elimination of tramming; conservation of man hours.

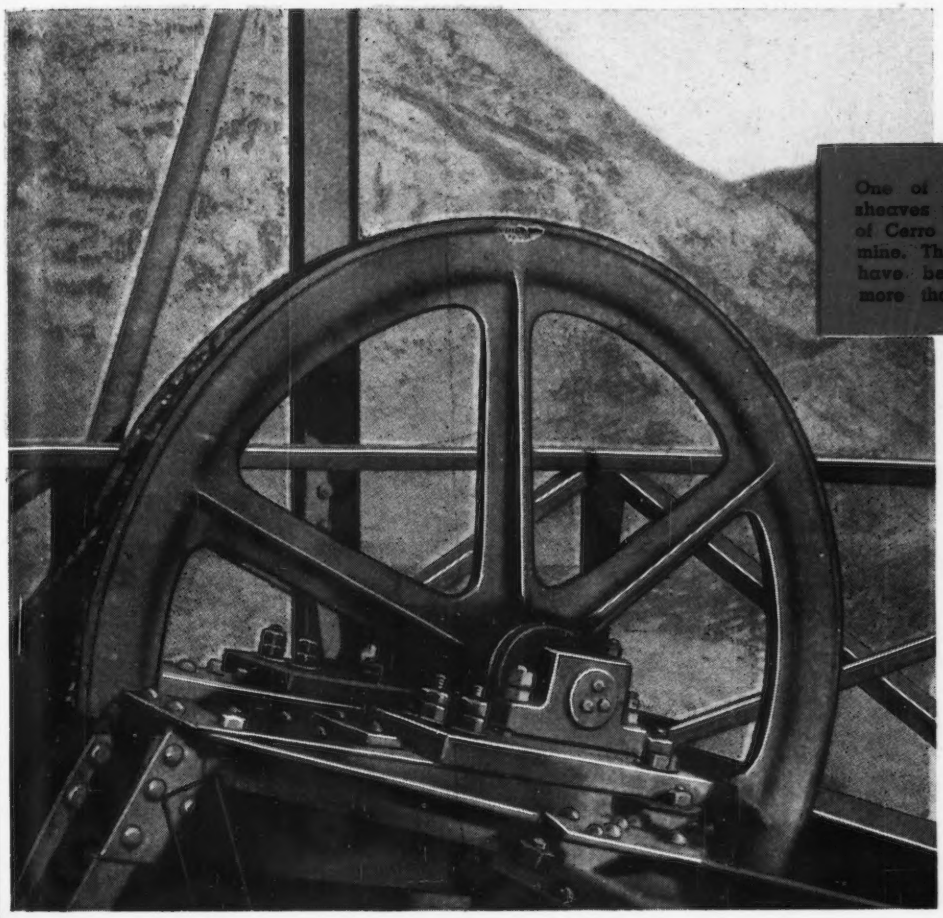
Three factors enter into the superiority of Timken Bits. One is design—including thread and shoulder construction; the second is material—Timken Steel produced in our own steel plant; the third comprises care and accuracy of manufacture—Timken Bits are produced by specialists in a plant devoted exclusively to bit manufacture and equipped with the most modern machines and appliances for this purpose.

Now is the time to check into your drilling costs and to begin to reduce them by the adoption of Timken Bits — if you have not already done so. The Timken Roller Bearing Company, Canton 6, Ohio.

Vulcan Electric Hoists and Allcasteel Sheaves earn "Repeat Orders" from Cerro de Pasco



Vulcan Electric Hoist operating underground at the Goyllarisquisga Coal Mine of Cerro de Pasco Copper Corporation, Oroya, Peru. Another similar Vulcan electric hoist operates underground at their San Cristobal copper mine. A larger hoist, now on order, will be equipped with power-operated brakes, single-reduction herringbone gears and modern safety devices.



One of the three Vulcan Allcasteel head sheaves recently installed at the main shaft of Cerro de Pasco's new Yauricocha copper mine. Three larger Vulcan Allcasteel sheaves have been giving satisfactory service for more than twelve years at Lourdes shaft.

AFTER determining, through satisfactory experience, that Vulcan Electric Hoists and Vulcan Allcasteel Sheaves can be relied upon for efficient, dependable service, Cerro de Pasco, like many other great mining companies, has placed orders with us for additional units of the same general type. And on every occasion we have given them our best possible product — because that's how Vulcan has steadily grown larger and stronger for nearly a hundred years.

No matter how large or how small the job, Vulcan builds an extra margin of quality into every product that bears its name. In hoists this means long trouble-free service —in sheaves it means less wear and tear on expensive wire rope—in both it means greater safety and lowest ultimate expense. We are proud of our good standing with Cerro de Pasco and other great corporations in many fields of industry but the smallest purchaser can rely upon receiving the same conscientious service.

Termination of Government contracts for other Vulcan products now permits better service to mining companies than has been possible for several years and we invite correspondence regarding present or prospective requirements for any of the items listed below. Our experienced engineers welcome opportunities to make helpful suggestions, whenever possible, without charge or obligation of any kind.

VULCAN IRON WORKS

Established 1849

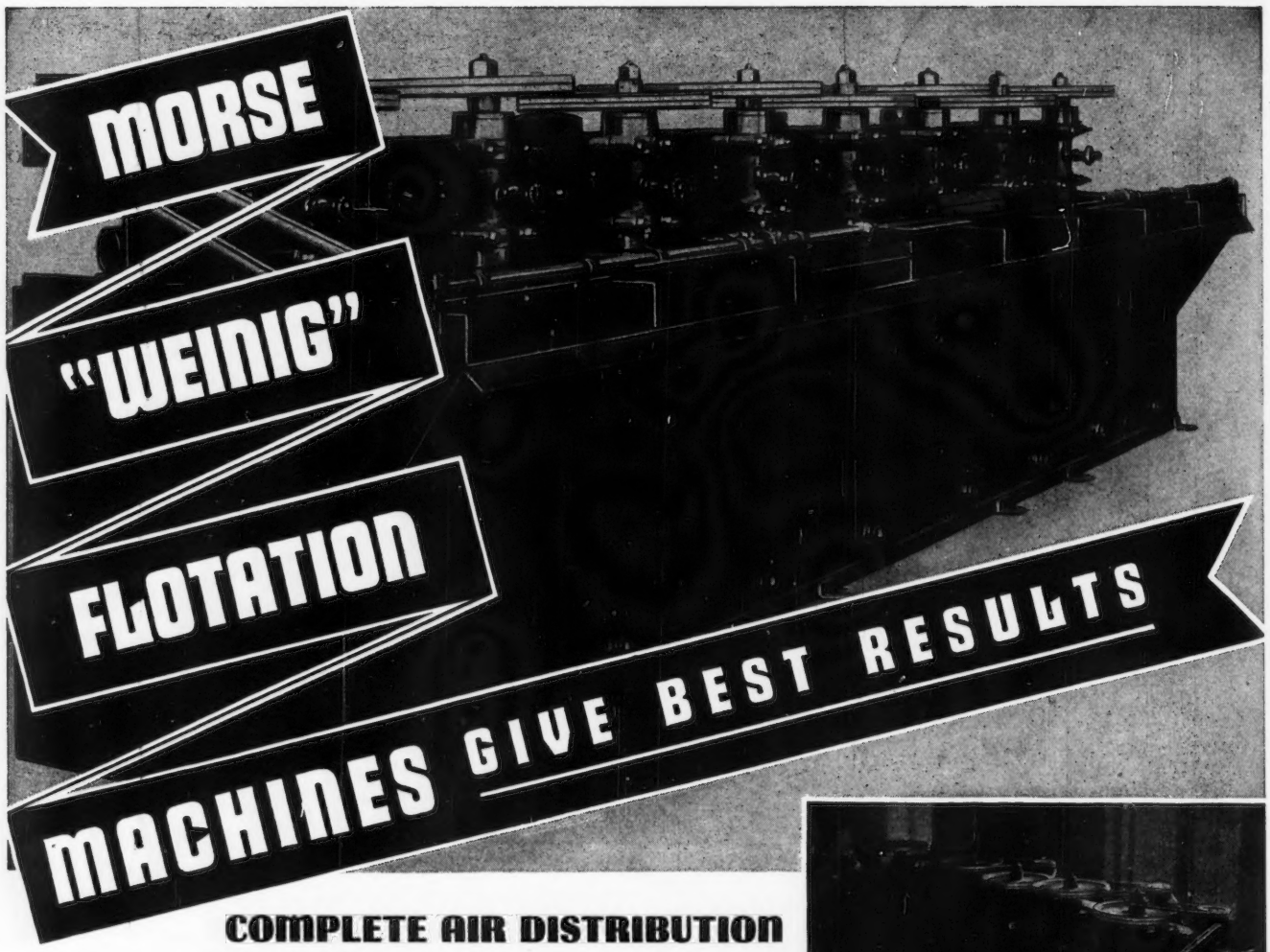
Main Office and Works **WILKES-BARRE, PA.,** New York Office 50 Church

Heavy-Duty Electric Hoists
Self-Contained Hoists
Scraper Hoists
Car-Spotting Hoists
Room Hoists

Shaking-Chute Conveyors
Chain Conveyors
Cast-Steel Sheaves and Gears
Cages, Skips and Gunboats
Coal-Preparation Equipment

Steam Locomotives
Diesel Locomotives
geared and electric drive
Gasoline Locomotives
geared and electric drive

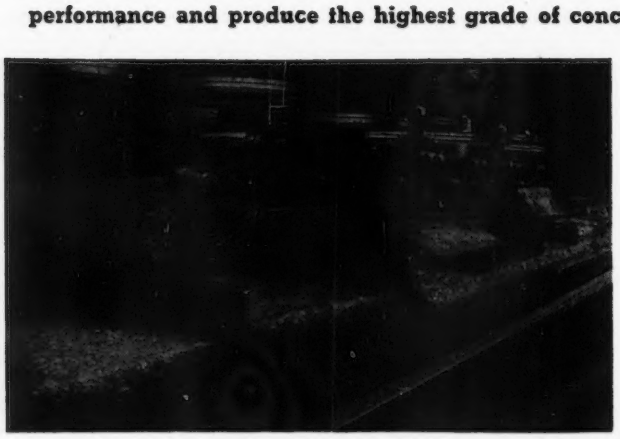
Load-Carrying Larries
Rotary Kilns, Coolers and Dryers
Crushing Rolls and Pulverizers
Briquetting Machines
Ball, Rod and Tube Mills



COMPLETE AIR DISTRIBUTION
"AGITATION PLUS" AGITATION

Exclusive Morse-"Weinig" features give more complete agitation and intimate incorporation of controlled air than has, heretofore, ever been attained. All feed to each cell passes through the Morse-"Weinig" Impeller. Pulp within the cell is recirculated through the impeller. Air, in controlled volume, is intimately combined with the pulp and reagents at the correct and vital point of the impeller during agitation. Extremely quiescent froth zones give the best metallurgical performance and produce the highest grade of concentrate.

MORSE-"WEINIG" CELLS IMPROVE METALLURGY



Low Maintenance Cost • Easy to Operate
Cell sizes from 6 to 100 cu. ft. per cell

The Morse-"Weinig" principle of "Agitation Plus" is accomplished without any increase in power. All cells are supplied with adjustable weir gates to control the level of pulp. Automatic float valve pulp level controls for a series of cells can be supplied, if preferred. Hard iron or rubber impellers, bottom and side liners. An air valve for "Positive Air Control" for each cell.

LITERATURE SENT UPON REQUEST

MORSE BROS. MACHINERY CO.

ESTABLISHED 1898

P. O. BOX 1708 • DENVER, COLORADO, U. S. A. • CABLE "MORSE"
1775 BROADWAY, NEW YORK CITY
SANTIAGO SOTO MARTINEZ, EDIFICIO JALISCO 503-EJIDO 7, MEXICO, D. F.
HEAD WRIGHTSON & CO., LTD., STOCKTON-ON-TEES, ENGLAND

HAZACORD PORTABLE CABLES

COME THROUGH

WITH *4-FOLD* RESISTANCE

Locomotive reel cables and mining machine cables are constantly subjected to the effects of flame, oil, water, soil chemicals and to the abuse of continual dragging across rough surfaces. Hazacord cables are rugged. They are sturdily built for the toughest jobs. Every type of Hazacord cable is constructed to withstand harsh service over a long period of time.

FLEXIBILITY — Fine gauge rope-laid wire conductors, fillers and insulation provide maximum flexibility for easy handling. Hazacord cables slide smoothly over, and slip around obstructions, resisting the rubbing and scraping of hard jagged surfaces which ordinarily cause abrasion.

INSULATION — Hazard standard rubber insulation of high tensile strength resists the tendency to "short" under abuse. Conductors are colored for identification.

FLAME RESISTANT JACKET — One important safety feature of the Hazaprene jacket is that it does not support combustion, rendering the cable flame resistant. It is, moreover, highly resistant to oil and grease as well as moisture — and all Hazacord mining cables are mold cured for the greatest possible density and toughness. For several years the Hazaprene jacket incorporating all these features has been standard on all Hazacord Mining Machine Cables, Locomotive Reel Cables and Electric Shovel Cables.

Even having these extra qualities, Hazacord cables are available without extra cost. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

Hazacord Portable Cables are available in many forms such as twin parallel, concentric and two conductor round. Send for 8-page bulletin "HAZARD MINING CABLES" Just out!

ARMY E NAVY

HAZARD

Insulated wires and cables for every mining use

4337

Full Drilling Shifts at Top Efficiency!

CP-34 SELF-ROTATING STOPER

THE light weight, perfect balance and ease of handling of the 95-lb. CP-34 Self-Rotating Stoper lessen operator fatigue — assure full operating shifts. The 24½" feed allows ample margin for easy steel changes. Collaring holes at difficult angles is facilitated by instant action of the feed control button. Two-pawl rotation prevents "wind-up" in drilling ravelly ground. Full cushioned piston and constant air blow to keep out sludge, minimum number of joints with wide bearing faces are among the many CP design refinements affording low maintenance cost and long service life. Send for Bulletin 891, or arrange for test of CP-34 Stoper under your own conditions.

Chicago Pneumatic manufactures a complete line of Stopers, Drifters and Sinker Drills. Write for full data.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

KENTUCKY-TENNESSEE CLAY COMPANY

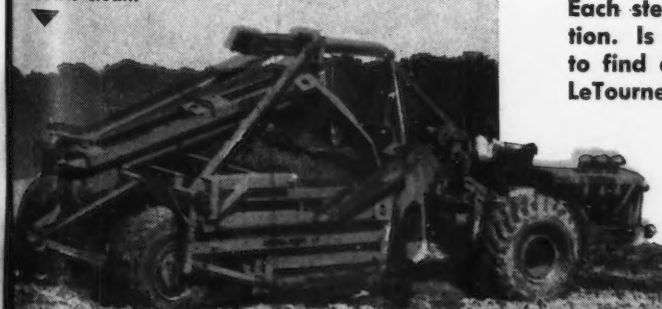
STRIPPING EVOLUTION LEADS TO

*TOURNAPULLS

▲ Overburden is 51' deep . . . mixed clay, sand, gravel, with 2 feet of saturated material over 5' of lignite and 3½' of sandy clay just above the 6 layers of high-grade industrial clay. Tournapulls load down grades as steep as 25%.

Hauls run to 2000', adverse grades to 7%. On 1875' one-way haul Tournapulls average 10 round trips per hour. Roads were built and are maintained by the Scraper units.

Much of material is sticky, some of it extremely wet. LeTourneau positive ejection tailgate keeps bowls clean. ▼



Stripping Contractor, H. W. Caldwell & Son Modernizes Operations with 3 Tournapulls

Increased demand during the past 40 years for high quality clay, produced by the Kentucky-Tennessee Clay Co., has resulted in a natural evolution of stripping methods and equipment at their Mayfield, Kentucky mine. For instance . . .

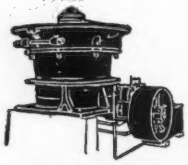
1. Originally, stripping was done by shovels loading into small narrow-gauge cars pulled by dinkies.
2. Next came shovels loading to trucks.
3. Then, crawler tractors with LeTourneau Carryall Scrapers combined load, haul and spread functions to produce at a still lower cost per yard and so took over the stripping.
4. Today, Contractor H. W. Caldwell & Son, handles the bulk of the stripping with 3 rubber-tired Tournapulls. These rigs extend the profitable haul range, move overburden at scraper costs beyond future areas of operation. This eliminates necessity for rehandling. Tournapull's big capacity and high speed saves time, increases output per unit and man hour.

Each step has resulted in increased output, lower costs, simplified operation. Is your stripping still in the 1, 2 or 3 stage? If so, it will pay you to find out how Tournapulls can earn equal benefits for you. Ask your LeTourneau Distributor for facts and figures TODAY! PQ9

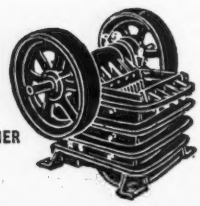
LETOURNEAU

PEORIA, ILLINOIS · STOCKTON, CALIFORNIA

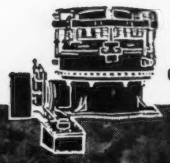
*Trade Mark Reg. U. S. Pat. Off.



PRIMARY BREAKER

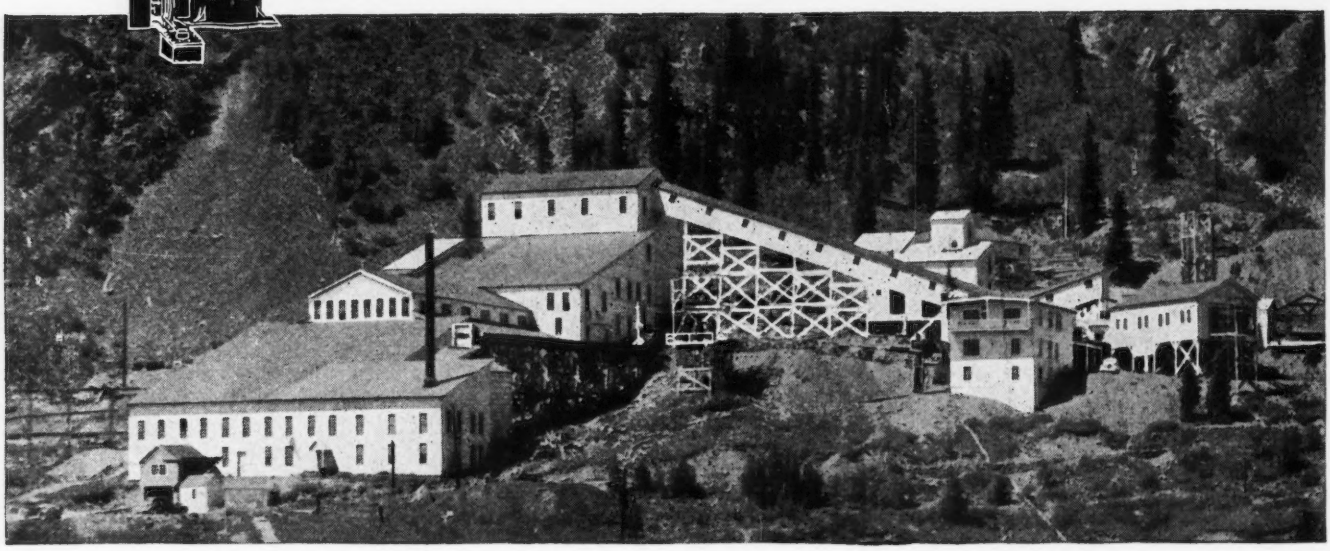


JAW CRUSHER



GYRASPHERE SECONDARY CRUSHER

WHERE WILL *your mill* FIT IN THE PEACETIME PICTURE?



Mill of Shenandoah-Dives Mining Co., Silverton, Colo.

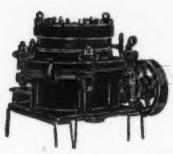
YOUR peacetime markets demand not only top production of ore—but rock-bottom costs. To meet these requirements *at a profit,* many mills have increased their efficiency by modernizing their equipment.

Start your modernization now! Begin with your crushing and screening equipment. Get a primary crusher of proved dependability in continuous crushing—a Telsmith Gyratory Breaker, or a Telsmith Roller Bearing Jaw Crusher—streamlined and strong, built for fast-feeding, high-speed crushing.

Follow it with a Telsmith Gyrasphere, or Intercone... secondary crushers which take an unregulated, unlimited choke feed... crush faster *and finer* to provide a more uniform feed for the ball mills.

Telsmith Crushers... with better screening by Telsmith Pulsators between them... insure top tonnage *consistently* with less power, less upkeep, less trouble *at lower cost per ton.*

Write Telsmith engineers about your peacetime production plans. Mining Equipment Bulletin E-1 on request.



INTERCONE SECONDARY CRUSHER

PULSATOR

GRIZZLY

HEAVY DUTY FEEDER

TELSMITH

Crushers • Feeders • Screens

MIN. 20R

SMITH ENGINEERING WORKS, 502 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

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BOSTON WOVEN HOSE
TRADE
MARK
AND RUBBER COMPANY
Merry Christmas

LAY·SET'S GREEN·LUBE

• GREEN-LUBE *is a superior grade lubricant made to our own specifications. It clings to the wires longer—protects them better—enables them to give increased service.*

ACCO

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Tacoma, Bridgeport, Conn.

HAZARD WIRE ROPE DIVISION
AMERICAN CHAIN & CABLE

ACCO
TRADE MARK

In Business for Your Safety

MAKES IT STILL BETTER

HAZARD'S All-Green rope is **LAY-SET** Preformed made of Improved Plow Steel — the best rope. Now this rope is *still better,* because it is completely protected with GREEN-LUBE *Every strand* is packed with our new superior green lubricant which gives added life to every wire. Not a single strand, not two strands, but every strand—yes, even every individual wire is completely covered by GREEN-LUBE The all-green color is an added protection to the highest grade rope made: **LAY-SET** Preformed I. P. S. Use only Hazard's All-Green rope.

Because... many likely mineral prospects are in areas of difficult terrain and in remote regions. They've got to be core drilled to determine whether or not they have value. The gas-driven Pioneer Straitline is just the drill for the job. Compactness and lightweight assure easy handling.

In the Pioneer you have a capacity up to 600 feet. Core recovered is 7/8" in diameter. Larger core can be obtained by using appropriate equipment, but drilling capacity is somewhat reduced.

The Pioneer Straitline may be counted on for dependable performance because it is built with the same precision engineering which makes Longyear core drills leaders in the field.

Power Transmitted Directly to Drilling Head

Full power from the motive unit flows through a clutch and 3-speed transmission direct to the drilling head which rotates the bit. There are practical advantages to you in this direct drive. First, neither belts or chains are used for driving the head. You thus eliminate play with loss of power which occurs in some degree when this type of drive is employed. Second, you get an even flow of full power to the bit. A smoothly rotating bit cuts faster and gives a higher percentage of core recovery.

Three Types of Motive Power

The standard gas power unit will be found most satisfactory for drilling from surface. It is water-cooled, has four cylinders and develops 10 h.p. at 1800 r.p.m.

Air and electric units of adequate power are also available. They are particularly adapted for underground drilling, although suited for surface work as well.

Here are more mechanical details

Swivel Heads— *You have a choice of either a screw feed or an hydraulic type of swivel head. Holes may be drilled at any angle with both heads.*

Clutch— *A clutch between motor and transmission permits the drill to be stopped instantly without shutting down the motor.*

Transmission— *The 3-speed transmission with gears running in oil allows a selection of three drilling and three hoisting speeds.*

Hoist— *The built-in hoist is sensitively controlled by two brake levers, permitting the rod load to be picked up smoothly while the motor is running.*

Frame— *The Pioneer is mounted on a structural steel frame with angle iron runners turned up on end. It is provided with sheaves for moving the drill short distances under its own power.*

Our new Bulletin No. E69 gives further information about the Pioneer Straitline. Write for it.

Longyear Core Drills are manufactured in a variety of capacities from 100' to 8500'. There are models for core and blast hole drilling. Longyear rods, bortz bits, core barrels and other supplies are carried in standard sizes.

E · J · LONGYEAR COMPANY

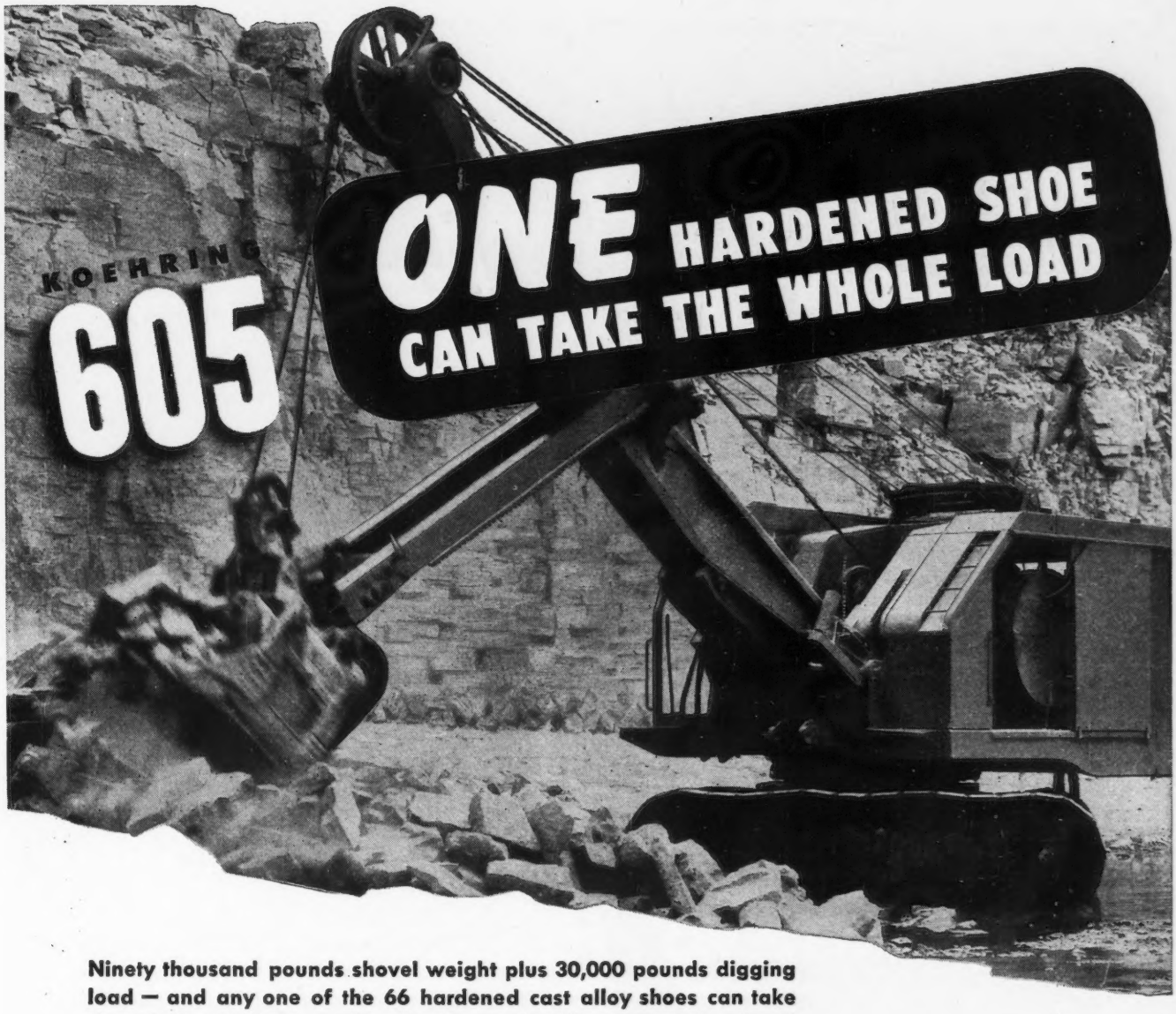
MINNEAPOLIS, MINNESOTA, U. S. A. NEW YORK OFFICE: 1775 BROADWAY

CANADIAN LONGYEAR, LIMITED, NORTH BAY, ONTARIO

REPRESENTATIVES:

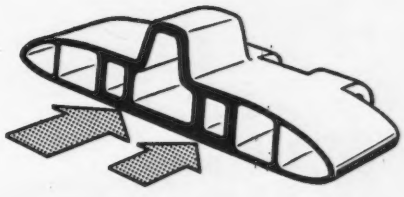
H. W. FOESTER, INC., EL PASO, TEXAS • R. S. McCLINTOCK, SPOKANE, WASHINGTON AND SAN FRANCISCO, CALIFORNIA • MINE AND CONTRACTORS SUPPLY CO., INC., BIRMINGHAM, ALABAMA • PERRAULT BROTHERS, TULSA, OKLAHOMA • THE MINE AND SMELTER SUPPLY COMPANY, DENVER, COLORADO AND SALT LAKE CITY, UTAH • NORTHERN COMMERCIAL COMPANY, FAIRBANKS AND ANCHORAGE, ALASKA • ATKINS, KROLL & COMPANY, INC., MANILA, PHILIPPINE ISLANDS • DOMINION DISTRIBUTORS COMPANY, ST. JOHN'S, NEWFOUNDLAND • LYNN, MacLEOD ENGINEERING SUPPLIES, LTD., THETFORD MINES, QUEBEC • PURVES E. RITCHIE & SON, LTD., VANCOUVER, B. C. • AUSTIN HOY AND COMPANY, LTD., AMERSHAM, BUCKS, ENGLAND • THE DENVER MACHINERY COMPANY, LTD., JOHANNESBURG, SOUTH AFRICA • WESTERN MACHINERY COMPANY, LTD., PERTH, WESTERN AUSTRALIA • CIA IMPORTADORA DE MAQUINAS, RIO DE JANEIRO, BRAZIL • JORGE A. PERRY & ALBERTO LOBO-GUERRERO, BOGOTA, COLOMBIA • GILDEMEISTER, HELTZEL & AMBOR CIA. LTDA., SANTIAGO, CHILE • INTERNATIONAL MACHINERY COMPANY, ORURO, BOLIVIA, LIMA, PERU • THE DOMINION CONSTRUCTION COMPANY, LTD., WELLINGTON, C. I., N. Z., NEW ZEALAND

DIAMOND CORE DRILLS • CONTRACT CORE DRILLING • SHAFT SINKING • GEOLOGICAL INVESTIGATIONS



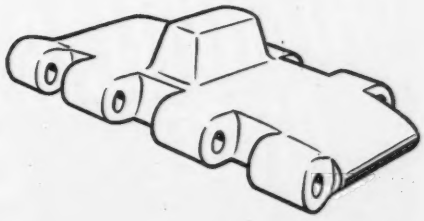
Ninety thousand pounds shovel weight plus 30,000 pounds digging load — and any one of the 66 hardened cast alloy shoes can take the whole 120,000 pounds. So strong, they'll outlast unhardened high carbon steel shoes at least three to one.

Double Thick WHERE THEY TAKE THE LOAD



Cross section shows double thick crawler roller paths, rigidly supported by double thick inside ribs. Cast, seamless, this shoe takes loads as a unit. Heat-treated alloy has basic strength, ductility to ride out shock loads, hardness to resist abrasion.

Self-Cleaning, OF COURSE! NO DIRT TRAPS



Like the shoes on Koehring equipment for 25 years, the hardened cast alloy shoes on the Koehring 605 have no dirt traps. Smoothly streamlined, they shed mud and stones and won't shower grit on the crawler belt rollers.

KOEHRING COMPANY • *Milwaukee 10, Wisconsin*

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

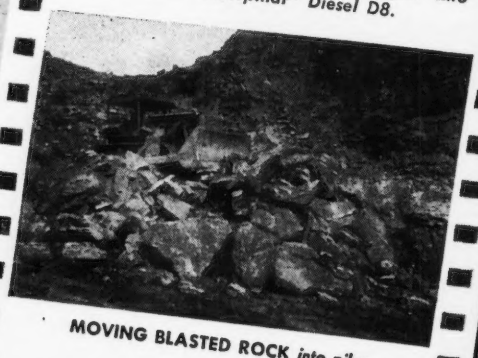
MOVING PICTURES

Yes, pictures of a few of the large number of moving jobs 'dozer-equipped "Caterpillar" Diesel Tractors can do around a mine. Let the pictures tell their own stories of the versatility which enables these rugged, untiring, big-capacity machines to rank first in their ability to earn more per invested dollar than any other piece of mining equipment.

CATERPILLAR TRACTOR CO. • PEORIA, ILL.

MOVING SALT *(by-product of potash mine) from end of conveyor belt.*

MOVING LEAN ORE *from stock pile into hopper with "Caterpillar" Diesel D8.*



MOVING BLASTED ROCK *into piles.*

MOVING ROCKS *on haul road beneath ore washing mill.*

MOVING EARTH *in building roadbed for railroad spur to mine.*

MOVING IRON ORE *in building stock pile to minimize trestle building.*

CATERPILLAR
REG. U.S. PAT. OFF.
DIESEL
ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

The discharged veteran wears this emblem. Remember his service and honor him.

Here's proof that Upson-Walton Tackle Blocks are better!

Established 1871

UPSON-WALTON tackle blocks are *engineered* so that the top or standing block can withstand not only the weight of the load but the hoisting strain as well. All U-W Safe Working Loads are assigned on this basis. *In many cases it is not necessary to use a shackle at the top connection* when you use U-W blocks—yet they cost no more than any other brand.

Compare these greatly increased Safe Working Loads!

	USUAL SAFE WORKING LOAD	UPSON-WALTON'S SAFE WORKING LOAD
3" Single	200 lbs.	300 lbs.
3" Double	300 lbs.	535 lbs.
3" Triple	400 lbs.	640 lbs.
4" Single	400 lbs.	510 lbs.
4" Double	550 lbs.	1040 lbs.
4" Triple	700 lbs.	1460 lbs.
5" Single	500 lbs.	880 lbs.
5" Double	750 lbs.	1370 lbs.
5" Triple	1000 lbs.	2030 lbs.
6" Single	1000 lbs.	1420 lbs.
6" Double	1500 lbs.	1900 lbs.
6" Triple	2000 lbs.	2750 lbs.
7" Single	1500 lbs.	1700 lbs.
7" Double	2000 lbs.	2580 lbs.
7" Triple	2500 lbs.	3000 lbs.
8" Single	1700 lbs.	2200 lbs.
8" Double	2450 lbs.	2850 lbs.
8" Triple	3200 lbs.	3500 lbs.
10" Single	2600 lbs.	2700 lbs.
10" Double	3400 lbs.	3650 lbs.
10" Triple	4200 lbs.	4900 lbs.
12" Single	3000 lbs.	3050 lbs.
12" Double	3750 lbs.	4600 lbs.
12" Triple	4500 lbs.	6250 lbs.

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THE UPSON-WALTON COMPANY

Manufacturers of Wire Rope, Wire Rope Fittings, Tackle Blocks

MAIN OFFICES AND FACTORY: CLEVELAND 13, OHIO

114 Broad Street, New York 4 | 737 W. Van Buren Street, Chicago 7 | 241 Oliver Building, Pittsburgh 22

NEW SOLES FOR WORN PADS

STOODY SELF-HARDENING

✓ Saves Money . . .

✓ Keeps Shovels on the Go!

WHEREVER equipment wear cuts your profit or raises overhead, Stoody Self-Hardening makes immediate savings. This economical hard-facing alloy is especially useful for combatting abrasion on *all* earthworking tools. It outwears the best manganese steel *two to one;* bonds firmly to manganese; won't chip under average impact and is easily applied either by oxy-acetylene or D.C. electric welding methods.

Every operator knows to get maximum protection on heavy equipment, thick hard-facing deposits are needed. Using ¼" bare electric Stoody Self-Hardening, you'll get them fast . . . in one pass alone! Deposits are possible up to ⅜" thick—no multiple welding —no tiresome scaling between passes!

For 20 years Stoody Self-Hardening has proved to be wear insurance for contractors using shovels, tractors, bulldozers, scrapers and all other earth moving equipment.

MAKE THIS TEST!

Stoody Self-Hardening costs only 50c per lb., f.o.b. Whittier or distributor's warehouse. Order a hundred pounds today, renew your worn equipment and check the increase in equipment life! You'll get *more* savings, *more* service, *greater satisfaction* from Stoody Self-Hardening! Available from 600 distributors throughout the U. S.

STOODY COMPANY

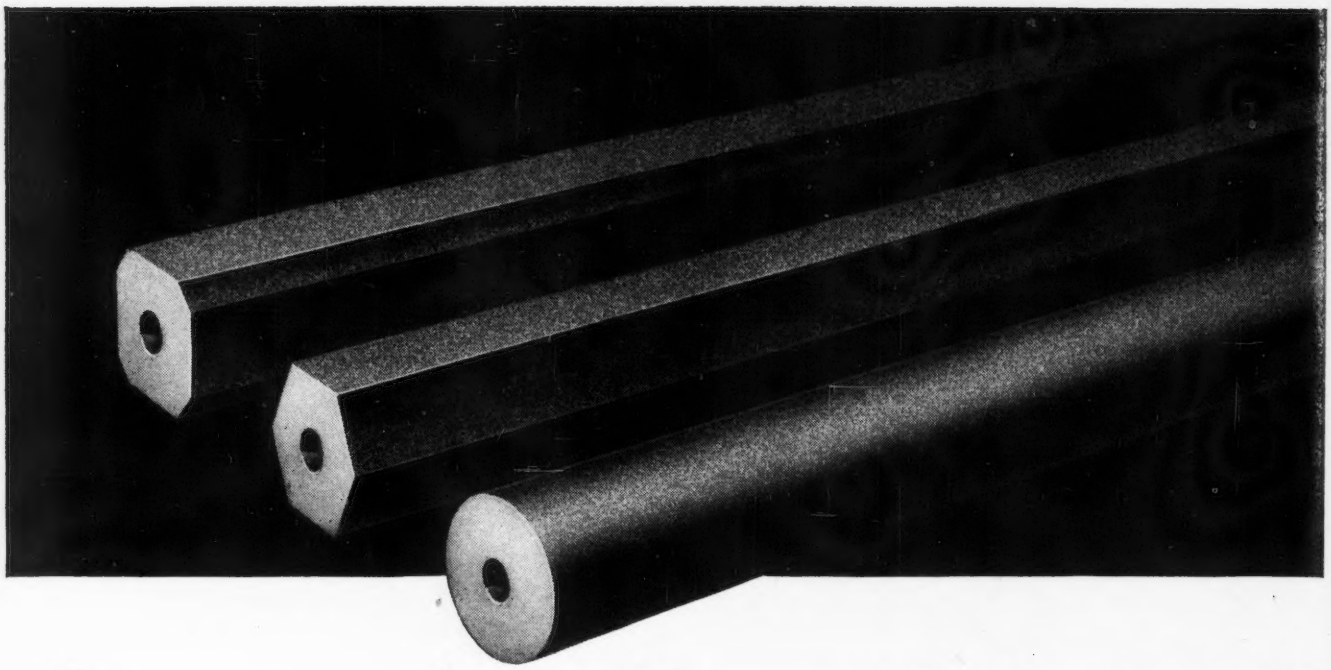
1140 WEST SLAUSON AVENUE • WHITTIER, CALIFORNIA

STOODY HARD-FACING ALLOYS

Retard Wear **Save Repair**

Through the war years, the cost of the job was secondary to *getting that job done.* But from now on, COST—both operating and maintenance—will be the all-important factor in the purchase of new heavy-duty mining equipment. When it comes to deciding what kind of power will operate that equipment at lowest cost, don't overlook the proved-on-the-job advantages of high-speed Cummins Dependable Diesels . . . their demonstrated reliability and long life . . . their easy, economical maintenance and service . . . their high horsepower output per pound of engine weight. Models for all types of heavy-duty mining applications . . . hauling, stripping, loading or stationary . . . 50 to 275 hp.

CUMMINS ENGINE COMPANY, INC.
Columbus, Indiana



Your rock drills can't do it all

You can own the finest drills ever made, but you won't get maximum results unless your drill steel is right.

When you carefully invest your dollars in good rock drills, be equally careful that you get Bethlehem Hollow Drill Steel. After all, the steel's the thing that actually does the cutting. When Bethlehem Hollow is working for you, there is no question of its ability to absorb hard knocks and *keep drilling*, even through the most quarrelsome rock.

In the blacksmith shop, you'll find that Bethlehem Hollow makes up readily, and doesn't get "fussy" in the heat-treating stage. This is because of its wide quenching range. You'll find, too, that the hole is always round, smooth, well centered; that the steel works equally well whether you thread it for detachable bits or forge on your own bits.

When ordering drill steel, always remember:

BETHLEHEM HOLLOW

makes a good drill better

★ BETHLEHEM STEEL ★

Job-Engineered by Robins . . .

this exclusive new Mine Conveyor is designed to get maximum production out of low coal veins with the greatest efficiency and economy. Faces that may have to be abandoned when worked by other methods can be operated profitably with the Robins Mine Conveyor.

This Job-Engineered Robins product combines more exclusive features than any other mine conveyor manufactured. It is only fifteen inches high along the belt line. Widths are twenty-four to thirty-six inches or more, and operating lengths up to three thousand feet carrying 300 tons per hour are common. The experience of more than half a century of Job-Engineering insures that take-up, idlers, and other features are all ideally adapted to the limited head-room encountered in working low coal.

Before you get beyond the talking stage, find out what Job-Engineering can mean to you. A note on your letterhead will bring a Robins Job-Engineer to your desk to help you with your planning.

AMERICA'S ONLY *COMPLETE* MATERIALS HANDLING SERVICE

Hewitt and Robins unite to offer you 134 years of combined experience in Job-Engineered rubber products and machinery designed to answer every materials handling problem you may have.

ROBINS

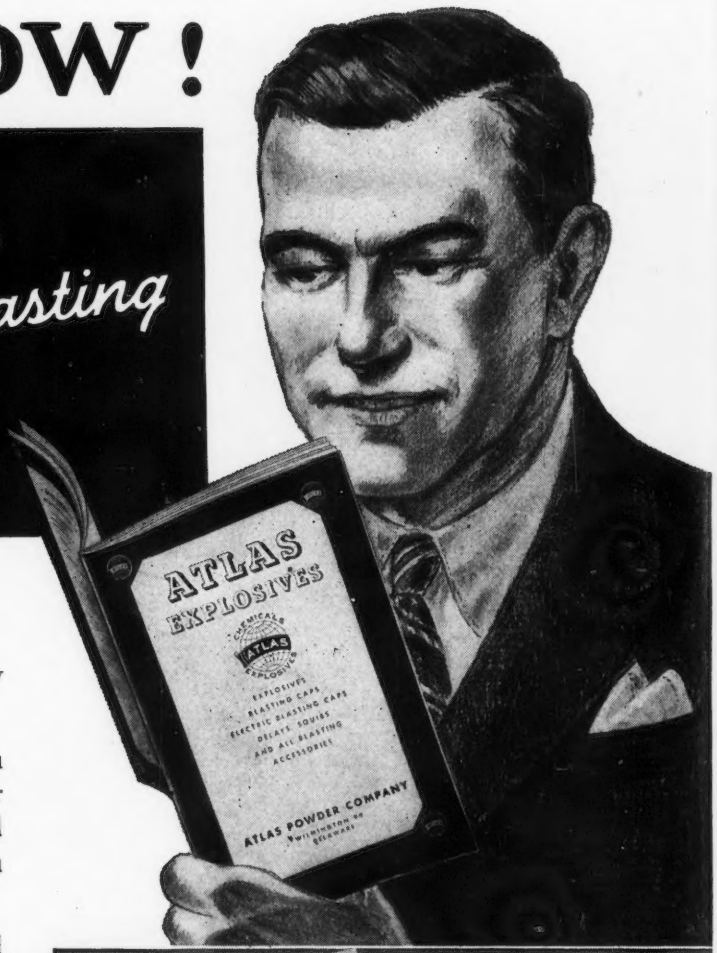
CONVEYORS INCORPORATED

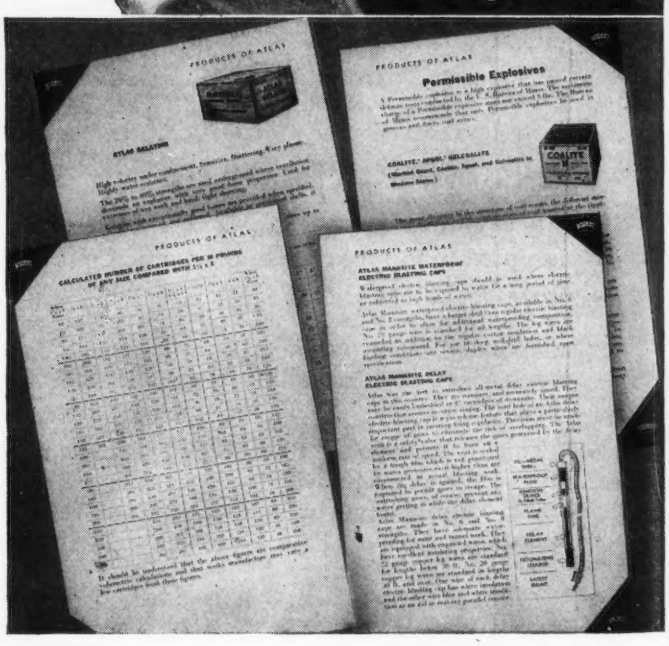
PASSAIC, NEW JERSEY

DIVISION OF HEWITT RUBBER CORPORATION

READY NOW!

The Latest Information About Explosives and Blasting Equipment





IT's just been released—and it's completely up to the minute!

This new, pocket-size Atlas Catalog brings you full details about the Atlas line of explosives. For your further convenience, products are grouped for ready reference so that you can find what you want at a moment's notice.

Nor is this attractive informative booklet limited to explosives only. Here you will also find complete and up-to-date information about blasting caps, electric blasting caps, delay electric blasting caps, electric igniters, blasting machines, rheostats, galvanometers, fuses—all necessary blasting accessories.

In order to bring you complete specifications and descriptions in the handiest possible form, this new Atlas Catalog does not contain instructions on use. It suggests what to use for the best results—not how to use it.

But for everyone interested in safety, economy and efficiency as applied to blasting, this brand-new catalog is an absolute must. Purchasing agents, superintendents, operators and contractors are especially invited to write for a copy—or to ask the Atlas Representative for one.

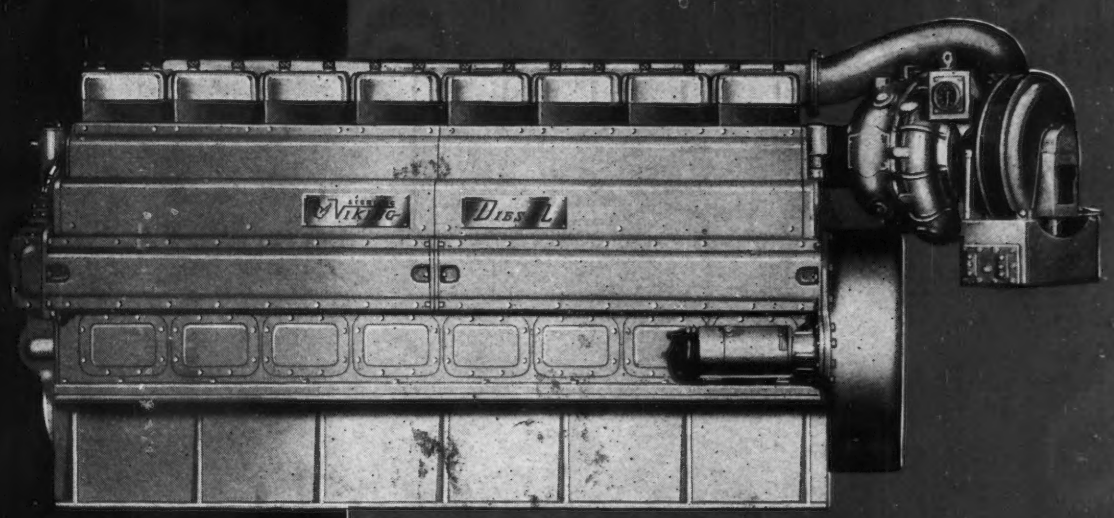
ATLAS EXPLOSIVES
"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

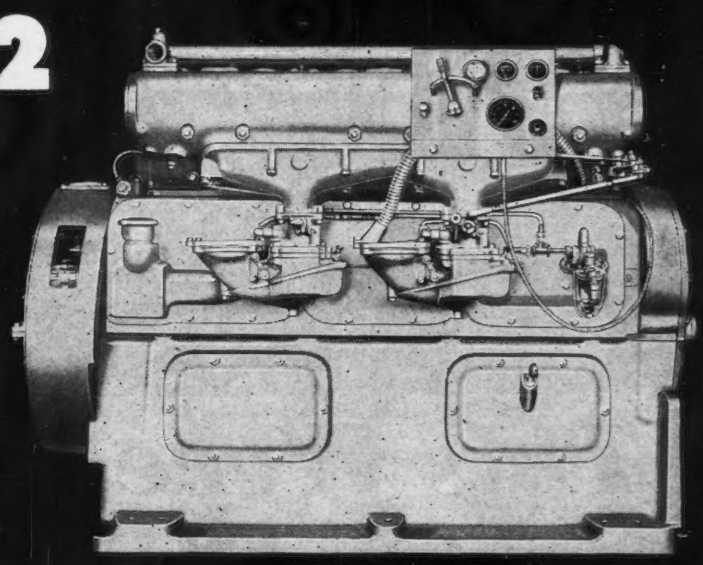
STERLING POWER

1



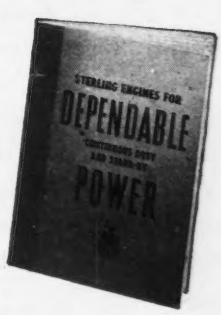
...ready now in the power range you want!

2



STARTING from the Petrel six cylinder natural gas engine providing a power range from 68 to 186 horsepower, to the Supercharged Admiral 12 delivering 1320 horsepower, you have a choice of 14 models—gasoline, gas, butane and diesel fuels—from which to select that engine best suited to your requirements. Sterlings are known by their service records to incorporate the best in stationary engine design and engineering. Acquaint yourself now with the features and service advantages of the new Sterlings.

State briefly the power job you have in mind. Draw on Sterling's half century of experience. No obligation.



1 Sterling Viking Diesel 8 cyl. supercharged engine. Viking Diesels are available in 6 and 8 cylinder models. 110 to 650 hp.

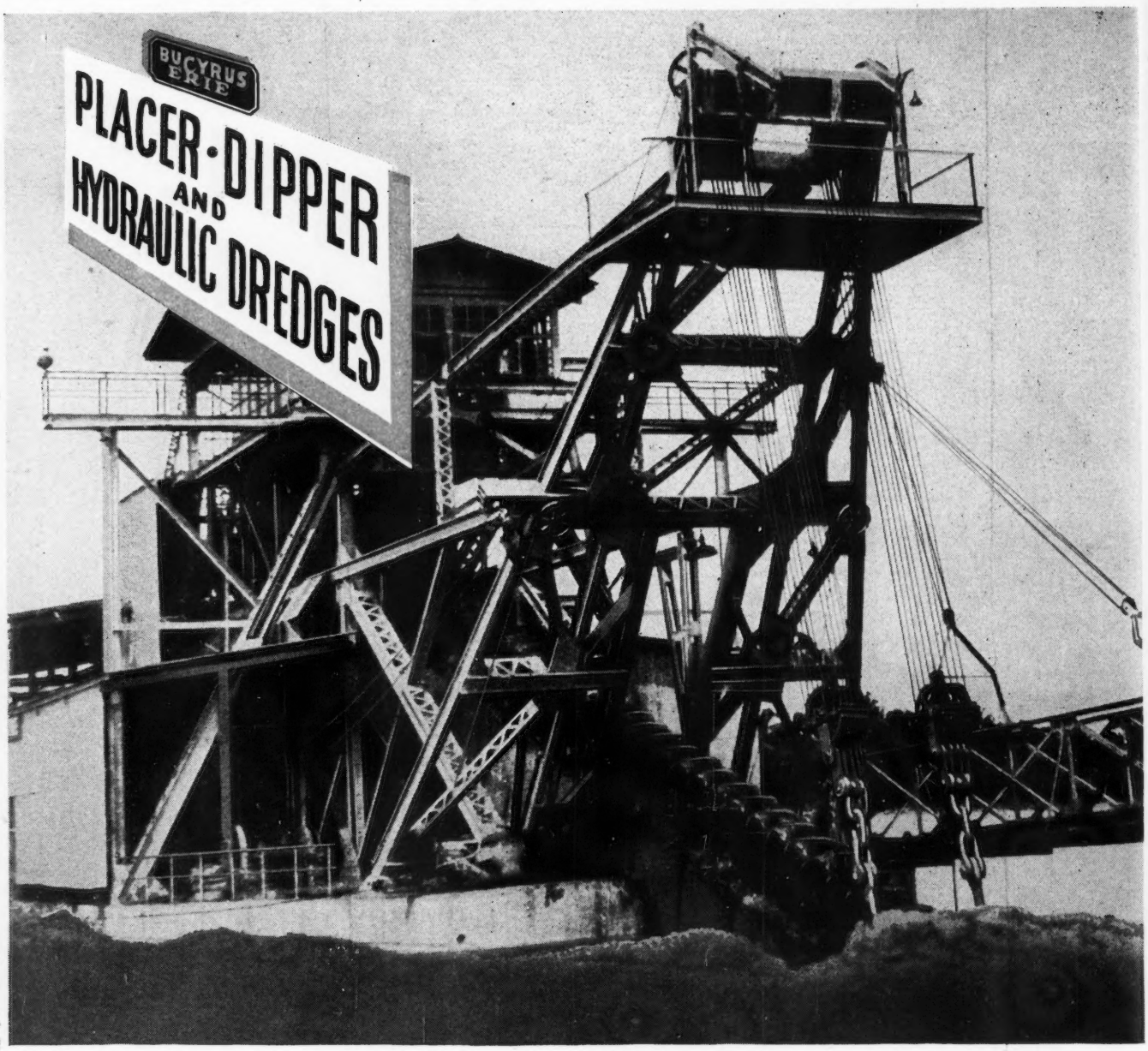
2 Sterling Petrel 6 cyl. gasoline engine. 72 to 214 hp.

This new booklet "Dependable Power" is yours for the asking. Pictures the entire line and tells why Sterlings won their popularity. Ask for it!

STERLING ENGINE COMPANY, 1264 NIAGARA ST., BUFFALO 13, N. Y.

New York City, 900 Chrysler Bldg. • Washington, D. C., 806 Evans Bldg. • Chicago, Ill., 855 Board of Trade Bldg.

DISTRIBUTORS IN PRINCIPAL CITIES



If This Were Your Placer Dredge . .

Had this dredge been built for you, its design, specifications and appearance would all be different . . . because every Bucyrus-Erie dredge is built to fit the requirements of a particular operation. Designed specifically to suit the operating methods and conditions peculiar to your job, your dredge would also include all those modern time- and money-saving conveniences that go so far in helping the crew cut costs by maintaining maximum yardage.

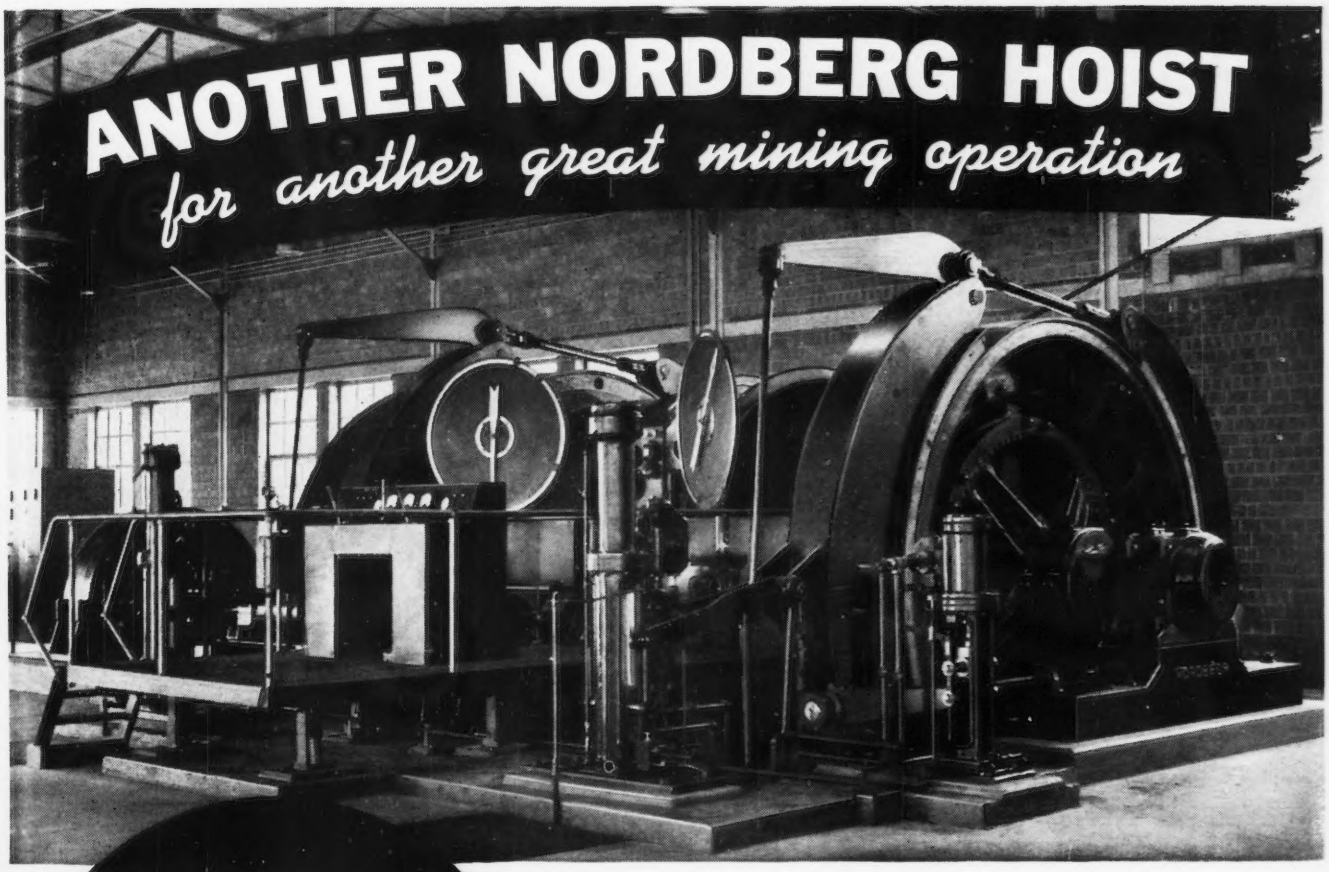
In spite of its individual design and appearance, however, your dredge would have one important similarity to each of the hundreds of Bucyrus-built units operating all over the world. It would incorporate the experienced, years-ahead engineering and manufacturing which go to make all Bucyrus-Erie excavators leaders in their fields.

Pioneer of placer dredge building, Bucyrus-Erie maintains leadership through a policy of continual improvement and development based on field-tested experience and an intimate knowledge of dredging operations.

3D45C

BUCYRUS-ERIE COMPANY
SOUTH MILWAUKEE, WISCONSIN

ANOTHER NORDBERG HOIST
for another great mining operation



HOIST DATA

Drum Diameter	10 feet
Drum Face	72 inches
Rope Diameter	1⅝ inches
Rope Length	1480 feet
Rope Speed	1500 feet per minute
Ore Load	17,920 pounds
Total Rope Pull	33,180 pounds
Motor	1250 Horsepower

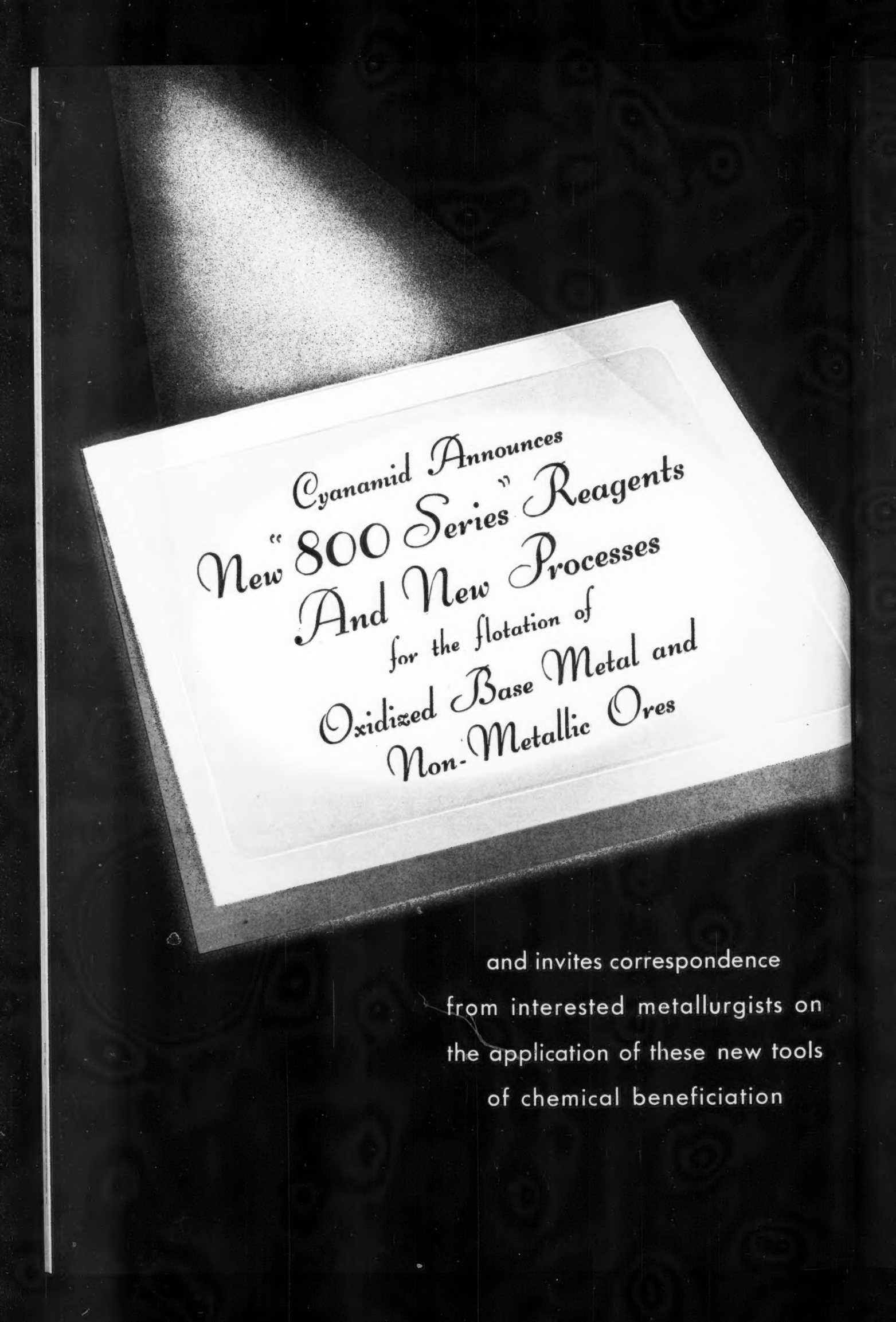
Among the recent hoist installations made by Nordberg is this double drum hoist for Colorado Fuel and Iron Corporation's expanded iron ore production at Sunrise, Wyoming. This is another instance where Nordberg equipment has been selected for an important hoisting service. That Nordberg hoists are used by so many prominent mining companies is evidence of satisfactory service given. For heavy lifts at high speeds from great depths, the installation of a Nordberg hoist assures the utmost in dependability and safety.

Nordberg hoist engineers will gladly aid in the solution of your hoisting problem. Their experience over many years in designing many of the world's great hoists is available to you.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN
NEW YORK • LOS ANGELES • LONDON • TORONTO • JOHANNESBURG

NORDBERG MACHINERY

NORDBERG HOISTS


Cyanamid Announces
New "800 Series" Reagents
And New Processes
for the flotation of
Oxidized Base Metal and
Non-Metallic Ores
and invites correspondence
from interested metallurgists on
the application of these new tools
of chemical beneficiation

As part of a broad program of reagent and process development for the treatment of oxidized base metal and non-metallic ores, Cyanamid is now privileged to announce promising laboratory results from the use of the new "800 Series" Reagents and new processes, and pilot-plant confirmation of these results on current Hematite tailings. Operating during the 1945 season, this pilot plant verified test results on current tailings from three different mining operations.

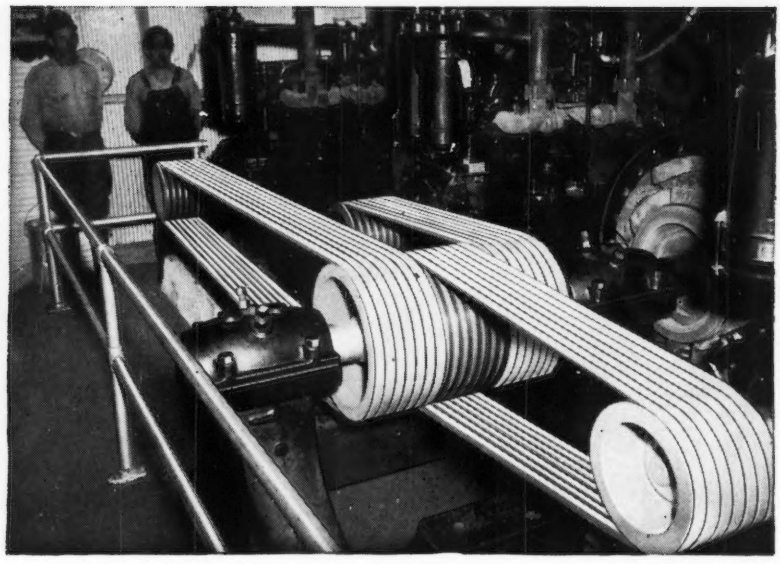
Laboratory results indicate that these new Cyanamid Flotation Reagents and processes are equally effective on samples of Hematite from other current tailings and accumulated tailings ponds; on magnetic and non-magnetic Taconites; and Eastern Magnetite and Martite.

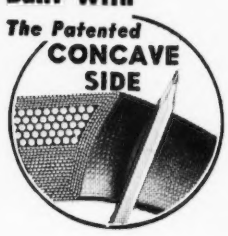
Excellent laboratory results have also been secured on Feldspar and Garnet. Mill data obtained from treatment of these ores will be released at a later date.

At this time we invite correspondence, or discussion with Cyanamid Field Engineers, as a preliminary to further representative tests on your ore in the Cyanamid Mineral Dressing Laboratory and their confirmation in mill operation.

Product	Mesabi Current *Tailings*	Mesabi Old *Tailings*	Eastern *Magnetite*	Eastern *Martite*	Mesabi *Taconite*
Flotation Feed % Fe	20.16	29.90	22.90	26.52	23.16
Flotation Concentrate					
% Fe	58.69	60.39	65.49	61.53	59.10
% SiO_2	7.98	9.02	5.68	5.25	11.50
Recovery % Fe	91.90	96.61	91.13	90.23	93.76

AMERICAN CYANAMID COMPANY 30 Rockefeller Plaza, New York 20, N. Y.





There's a very definite reason for this fact

Your **GATES VULCO ROPES**

Are Today Making Performance Records *NEVER EQUALED* by *ANY* V-Belts Before!

Early in the war, it became perfectly clear that Army tanks, tractors and self-propelled big guns in *combat service* simply *had* to have V-Belts of greater strength and durability than had ever been built before. Gates developed these greatly superior V-belts through intensified, specialized research — and here is why this fact is now important to YOU:——

Here is the reason

Every improvement developed by Gates for these Army V-belts has also been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.

Here is one of the very few instances in which improvements developed primarily for military use could be passed on *immediately* to you. Ordinarily, *you* would have had to wait. An exception was made in the case of Gates V-belts because it was recognized that industry needed the best possible V-belts in order to achieve the greatest possible production—and maximum production was vitally essential.

That is why Gates has been able to pass on to you, day by day, every V-belt improvement developed for our armed forces during the war — and that is why your *Standard* Gates Vulco Ropes are today outperforming *any* V-belts ever built before!

Gates — THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER CO.

Engineering Offices and Jobber Stocks In All Large Industrial Centers

4512

GATES VULCO ROPE DRIVES

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BEAR BRAND XANTHATES

Non-Frothing Collectors

Bear Brand Xanthates are strictly collector reagents and, therefore, create none of the control difficulties experienced with reagents which have *both* collector and undesirable frothing characteristics.

These universally accepted reagents employed in any necessary quantity accomplish the desired result without complicating control conditions.

GREAT WESTERN DIVISION
THE DOW CHEMICAL COMPANY
SAN FRANCISCO • CALIFORNIA, U.S.A.

pioneer producers of Xanthates
for metallurgical use

GREAT WESTERN DIVISION • THE DOW CHEMICAL COMPANY • BEAR BRAND PRODUCTS

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

A Byword in Wire Rope:

— FOR 6 BIG REASONS!

YOU LEARN A GREAT DEAL from individual service records about the efficient performance, the low average cost of Roebling "Blue Center" Steel Wire Rope. But records tell you only part of the story . . . of its toughness, its reserve strength, its basic dependability under *all* conditions of operation.

What makes "Blue Center" a rope you can choose with full confidence? The Roebling ***reputation,*** for one, and the superior Roebling-made ***steel*** in the wires.

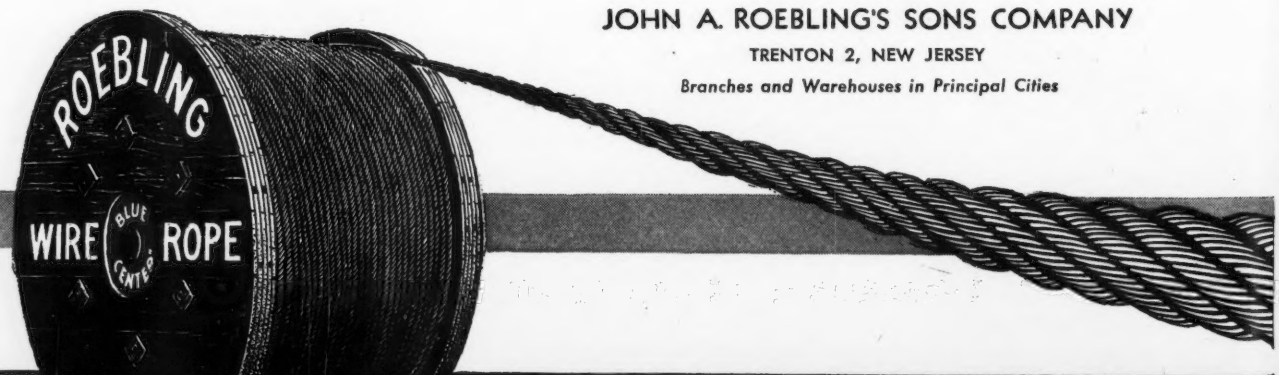
There's the ***skill*** born of a century's experience that goes into the rope's fabrication, the modern, unsurpassed ***facilities*** used.

Add to the never-ending ***research*** that gives you longer rope life, the practical ***engineering*** that assures the best rope for your purpose.

Remember those facts when you order from America's first wire rope maker. They back up the performance you can expect from every reel of Roebling Wire Rope, preformed or non-preformed . . . and every correctly designed Roebling "Blueclad" fitting.

Now that increasing quantities of Roebling Wire Rope are available, we suggest you place your orders early. Call or write our nearest office . . . a Roebling engineer will help you select the correct rope and get full productive life from it.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



Wire Rope and Strand • Fittings • Slings • Cold Rolled Strip • Round and Shaped Wire • Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels • Aircord, Swaged Terminals and Assemblies • Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

ROE

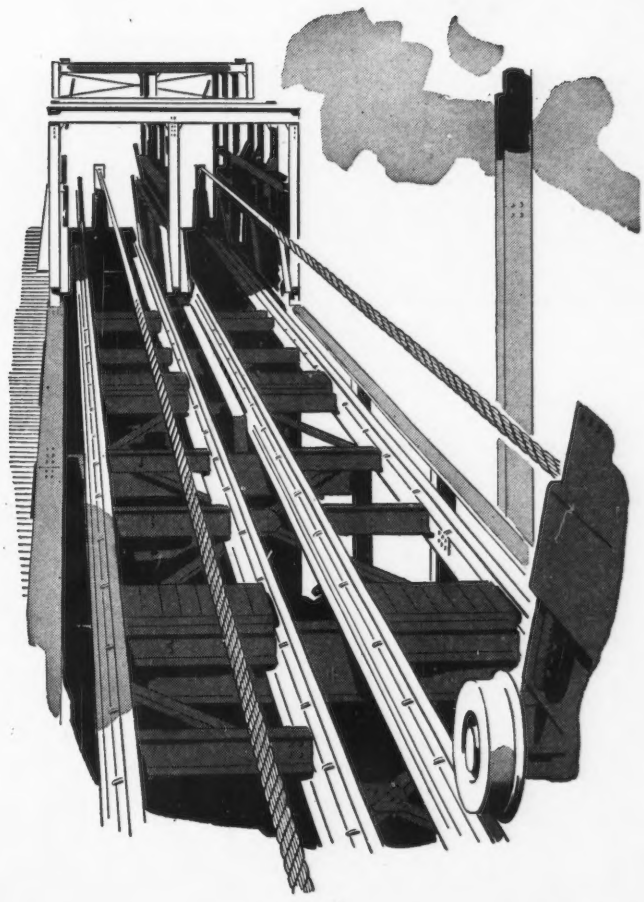
PACEMAKER IN

MEET THE *NEW*

MARION

A BIGGER AND BETTER

"BUY ROEBLING"



ROPE REMINDERS

Proper maintenance of wire rope pays off. And it's also a good slogan to remember in keeping comparative records of wire rope service.

It's desirable to keep accurate, complete records to check on operation. But even the most carefully kept records may be misleading, unless correctly analyzed.

For example, time on the job is not necessarily a yardstick of service. Ropes working less than average may have to contend with corrosion. Besides, a rope that operates only a few days a month may get less attention and care than a steadily working one.

The one invariable rule in record-keeping is that each installation must be considered individually. That's where Roebling engineers can be of invaluable service to you. They know wire rope, and they've had experience with a wide variety of rope-operated installations. It will pay you to consult them.

BLING

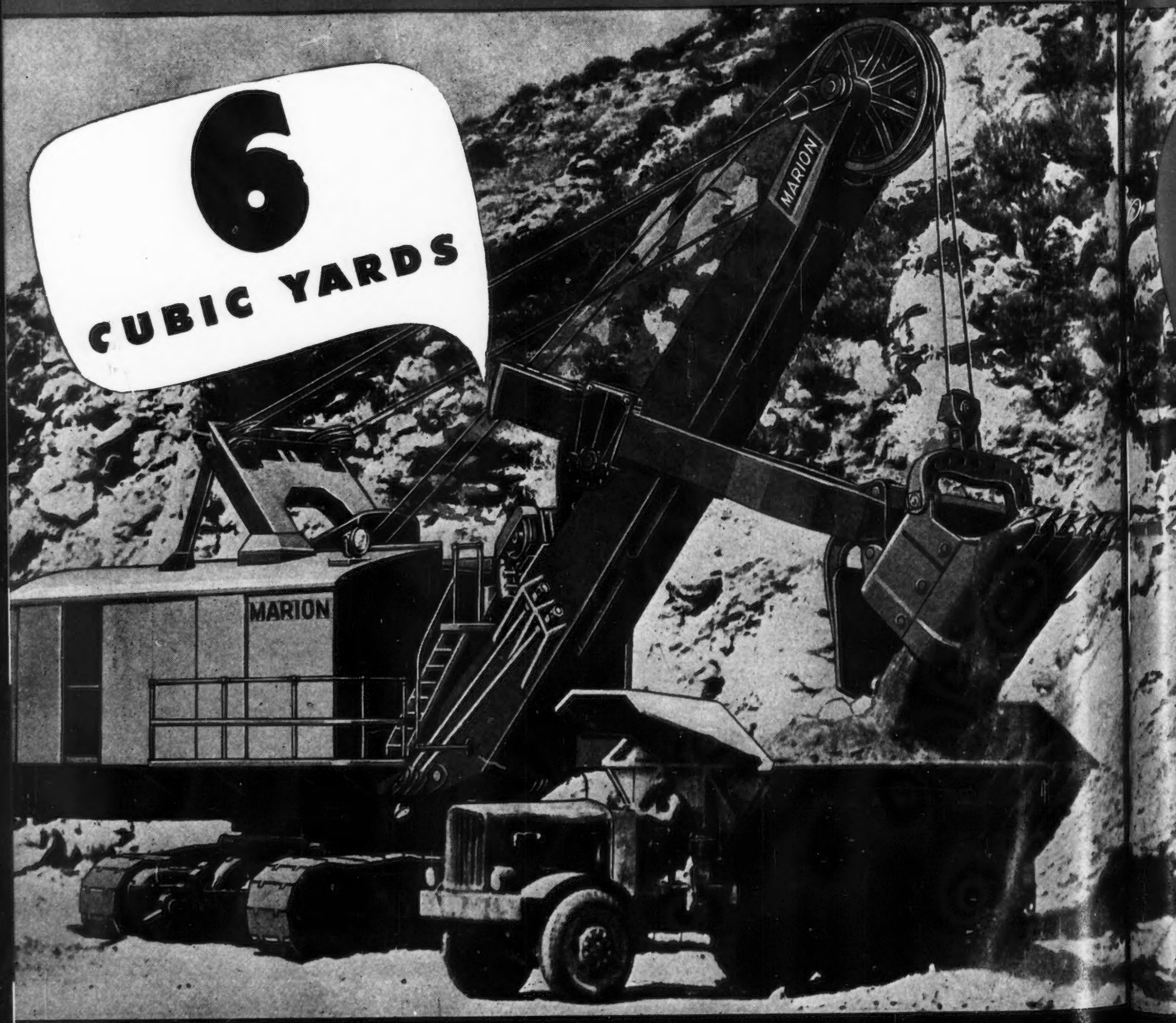
JR ROEBLING

WIRE PRODUCTS

151M

ROCK SHOVEL!

A BIGGER AND BETTER



THE MARION STEAM SHOVEL CO

Here it is...
WITH EVERY FEATURE NECESSARY
FOR
HEAVY DUTY SERVICE
OUTSIDE DIPPER HANDLE
TWO-PIECE DIPPER
SINGLE HITCH TO DIPPER
AMPLIDYNE - ROTOTROL CONTROL
POWER - SPEED - WEIGHT
COMBINED TO MAKE THIS THE
MACHINE OF TOMORROW
WHAT IS YOUR PROBLEM?
3/4 CU. YD. TO 40 CU. YDS.
COMPANY • MARION, OHIO

"It's the boss, Bill, carrying Taylor Spiral Pipe across the threshold. He says he's now MARRIED to it!"

Don't be wedded to the old ways!

Of course it's bad engineering to be married to any one product or practice. But it's still worse to be wedded to tradition. In the matter of pipe for everyday services, too many people are. They automatically use Standard Thickness Pipe for any application that doesn't call for still heavier pipe.

There is only one thing wrong with this practice of using Standard Thickness Pipe for all run of plant services, but it's a big wrong: Standard thickness pipe costs too much! It costs too much because Taylor Spiral Pipe will handle a large percentage of the services that are ordinarily assigned to Standard Thickness Pipe—handle them adequately and with strength and service life to spare; yet at far lower cost.

Taylor Spiral effects a drastic reduction in the cost of all moderate and low pressure piping because it has remarkable strength in ratio to its weight. The strength is gained through the spiral construction—the spiral seam, reinforcing it from end to end, that makes it the strongest type of pipe of its weight. The light weight means economy at every step . . . lower initial cost, shipping cost, handling cost, erection cost—lower cost of supporting structures, too.

As a result the installed cost of Taylor Spiral in many cases is no more than half that of the heavier pipe it so well replaces.

Switching to Taylor Spiral Pipe for services like those listed is made easy by the complete range of sizes and wide variety of fittings. Thicknesses range from 12 to 6 gauge; sizes from 6″ to 42″; joint lengths up to 40 ft. All types of end joints and couplings, all kinds of fittings and specials or fabricated assemblies are produced by Taylor Forge & Pipe Works, assuring complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS

General Offices & Works: Chicago, P. O. Box 485 ★ New York Office: 50 Church St. ★ Philadelphia Office: Broad Street Station Bldg.

CHANGE TO TAYLOR SPIRAL PIPE FOR:

- High and Low Pressure Water Lines
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- Blower Piping
- Sand and Gravel Lines
- Industrial Gas Lines
- Oil and Gas Gathering Lines
- Swing Pipe
- Spray Pond Piping
- Hydraulic Mining
- Dredge Lines

"STEEL MINING CASTINGS OF EVERY DESCRIPTION"

PULVERIZER HAMMERS
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PULVERIZER PLOW TIPS
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PULVERIZER LINERS
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HAMMER MILL GRATE BARS
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LINERS FOR BALL, ROD OR TUBE MILLS
•
LINERS FOR STORAGE BINS
•
LINERS FOR ORE CHUTES
•
LINERS FOR HOPPERS
•
SCREEN PLATES
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GRIZZLY BARS
•
CLASSIFIER CAMS
•
SPROCKET WHEELS
•
ROPE SHEAVES

CRUSHER HEADS
•
MANTLES
•
CONCAVES
•
CONCAVE RINGS
•
CHUTE PLATES
•
JAW PLATES
•
CHEEK PLATES
•
TOGGLE PLATES
•
TOGGLE BEARINGS
•
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•
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DIPPERS
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PLEASE SEND COMMUNICATIONS ABOUT CASTINGS FOR EXPORT DIRECT TO OUR PLANT AT JOLIETTE, QUE., CANADA

JOLIETTE STEEL LIMITED, JOLIETTE, QUE.

Sales Offices: Montreal • Toronto • Sudbury • Winnipeg • Vancouver

- America's most complete line of material handling buckets.

WE BUILD ALL 4 MATERIAL HANDLING BUCKETS

PMCO ALL PURPOSE

- SHOVEL
- PULLSHOVEL
- DRAGLINE
- CLAMSHELL

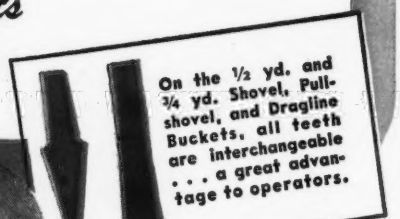
Clamshell
Sizes ⅜ to 2 yds.

We build a wider and more complete line of material handling buckets than any other manufacturer. Volume production methods enable us to build a better bucket with amazing economies in manufacturing.

FRONTS, BOTTOMS, SCOOPS, and TEETH, shown in red on buckets, are 14% manganese steel developing up to 120,000 tensile p.s.i. for long service life and hard abuse.

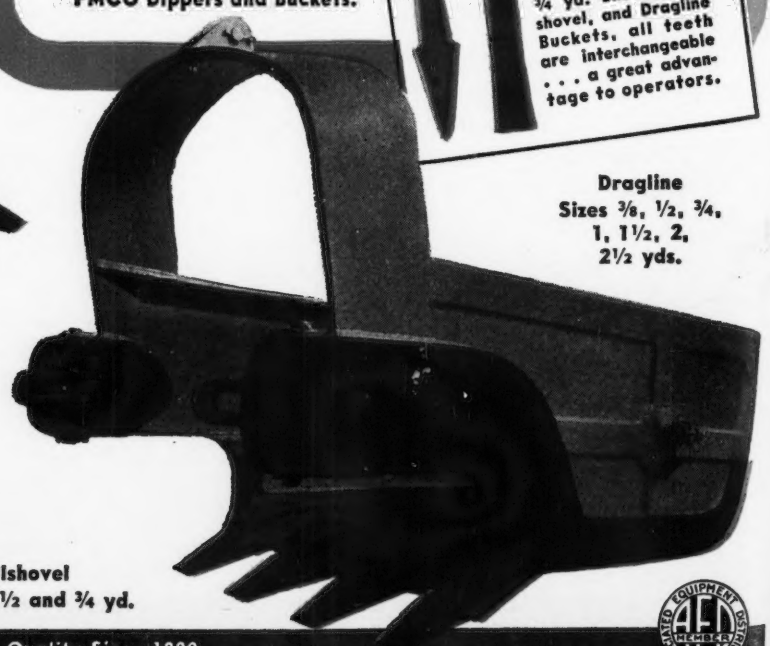
Experience Counts

See your shovel engineer or equipment dealer about PMCO Dippers and Buckets.



On the ½ yd. and ¾ yd. Shovel, Pullshovel, and Dragline Buckets, all teeth are interchangeable . . . a great advantage to operators.

Shovel
Sizes ⅜ to 18 yds.



Dragline
Sizes ⅜, ½, ¾, 1, 1½, 2, 2½ yds.

Pullshovel
Sizes ⅜, ½ and ¾ yd.

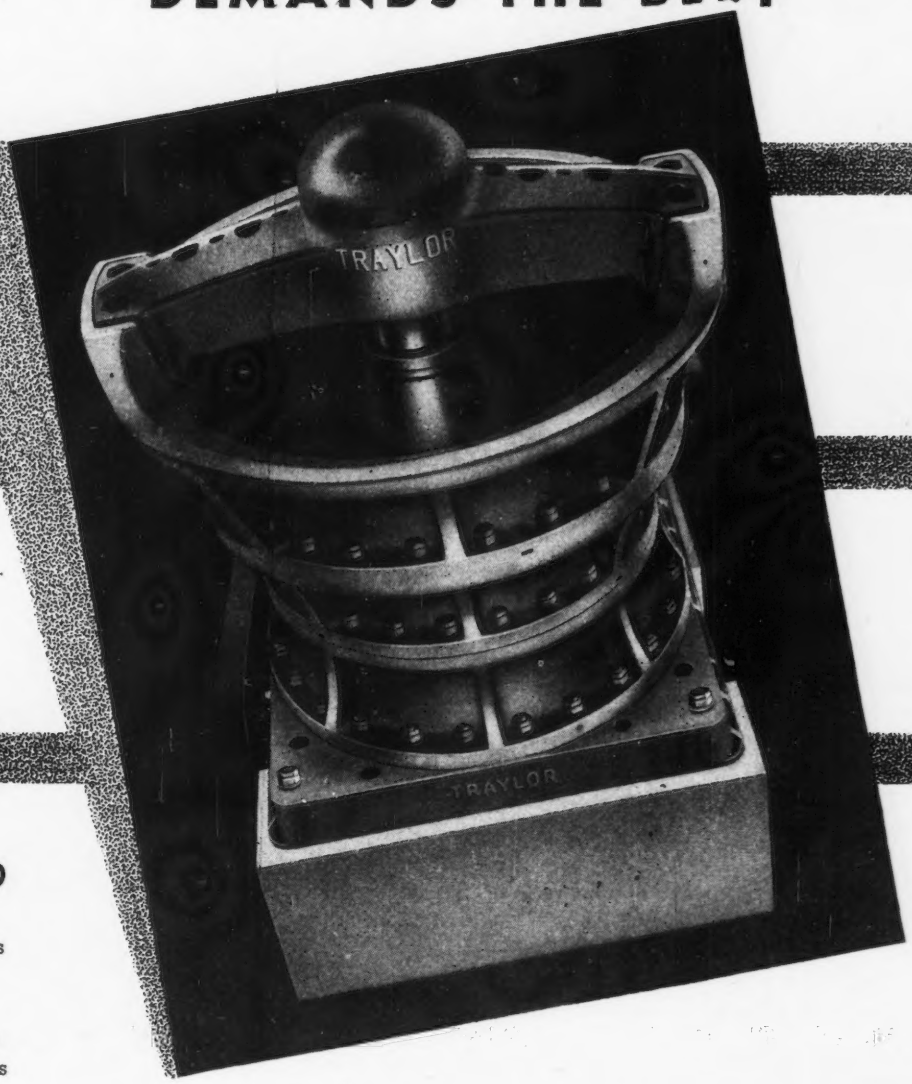
Quality Since 1880

PETTIBONE MULLIKEN CORP. CHICAGO 51, U. S. A.

WE OPERATE THE LARGEST AND MOST COMPLETE MANGANESE STEEL FOUNDRY IN THE UNITED STATES.

Top Production

DEMANDS THE BEST



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Jaw, Gyratory & Reduction Crushers
Crushing Rolls
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Complete Milling & Smelting Plants
Rotary Kilns, Coolers & Dryers

The Traylor Bulldog Gyratory Crusher assures top production—to help you restore your plant to pre-war production efficiency or to improve that efficiency and increase your plant capacity. It was the first successful big gyratory . . . . a 60" machine built about 25 years ago . . . . and its revolutionary design, for top production, has since served as a general pattern for all gyratories.

In the past quarter century we have built several more of the same size. The latest . . . . which is the strongest and most powerful 60" gyratory ever built . . . . is now delivering top production in the plant of the world's largest mining enterprise.

Bulldog Gyratories of the 54", 48" and 42" sizes, as well as hundreds of smaller sizes, have been furnished to plants, in various fields, working in every variety of rock and ore, all over the world where they continue to fulfill the demand for top production.

For greater efficiency and production it is to your advantage to ask our representative to call or write for Bulletin #4100.

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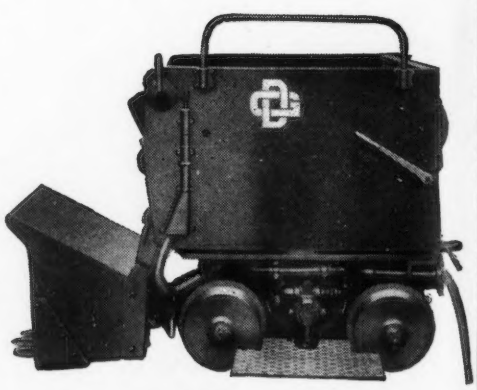
BIGGER mouthfuls of muck—faster clean-up of muck piles—are two big reasons why Gardner-Denver mine car loaders are preferred by economy-minded users. Here is a loader that's *engineered* to do a better job . . . that proves its case with performance, not claims. You'll want a Gardner-Denver Mine Car Loader because:

- **PLENTY OF POWER—Two 5-cylinder radial air motors—one powers the dipper for a big bite, while the other provides traction.**
- **PLENTY OF CROWD—Both motors function in the crowding action—a result of the famous Gardner-Denver fulcrum principle that puts the force where it is needed for a full dipper.**
- **PLENTY OF LIFTING SPEED—The speed of the dipper increases as it nears discharge position. Discharge is fast and clean.**
- **PLENTY OF ECONOMY—The Gardner-Denver Loader uses no more air than a drifting drill—stands up under tougher service—stays underground where it belongs.**
- **PLENTY OF SAFETY—All G-D 9 Loaders have a low center of gravity—less danger to operator from loader tipping or falling off track.**

Advance *your* headings faster with the G-D 9 Loader! For full information, write Gardner-Denver Company, Quincy, Illinois.



GARDNER-DENVER Mine Car Loader

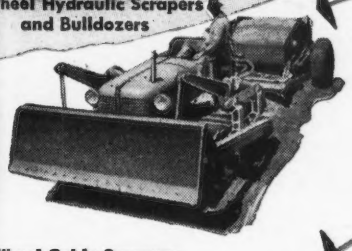
GARDNER-DENVER *Since 1859*

GAR WOOD ROAD MACHINERY

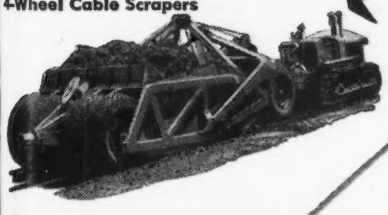
WITH ALLIS-CHALMERS DIESEL POWER

Puts you in the Driver's Seat

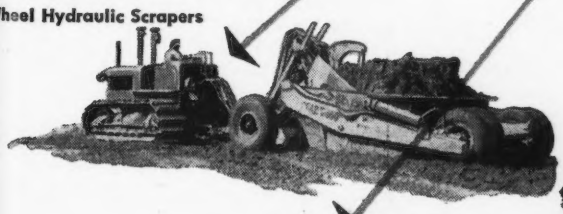
2-Wheel Hydraulic Scrapers and Bulldozers



4-Wheel Cable Scrapers



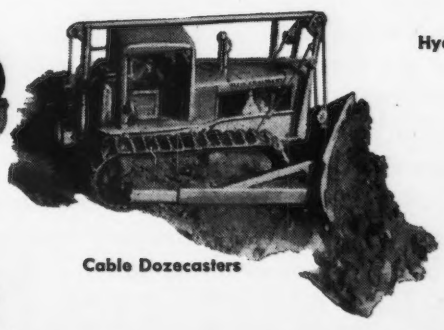
4-Wheel Hydraulic Scrapers



Heavy Duty Rippers

You're in full control of the yardage, the costs and timing of your earth moving jobs when you use Gar Wood Road Machinery. This equipment has proved its consistently high efficiency and complete reliability on thousands and thousands of jobs. It is the No. 1 choice of large numbers of users as shown by the present volume of orders—the greatest by far in Gar Wood history. It puts you in the driver's seat because it's built for the driver—to move the most earth with the least effort. Place your orders with your Allis-Chalmers dealer.

Cable Dozecasters



Hydraulic Dozecasters

Gar Wood Road Machinery is Sold Through ALLIS-CHALMERS Dealers Everywhere

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Airco Processes Help Break

MEETING the heaviest demands in their history in the face of the most serious manpower shortage and most stringent restrictions on production of equipment and replacements called for the greatest ingenuity on the part of mining men.

Modern Airco oxyacetylene and electric arc processes described on these pages played an important part in the industry's miraculous accomplishments. They helped to restore worn and obsolete equipment to use and to build new equipment not obtainable from war-converted suppliers.

So helpful have these processes proved that they will, no doubt, play an important part in future mining operations.

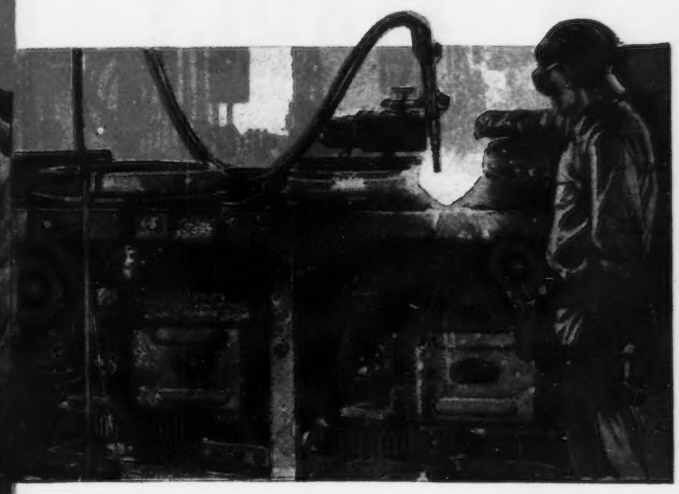
If you are unfamiliar with any of the applications listed in this advertisement, Airco's Applied Engineering Department will be glad to furnish complete information and assist you in applying them to your own operations.

Electric Arc Welding. Airco's famous "Hornet" and "Wasp" D.C. Arc Welders and "Bumblebee" A.C. Welders serve many of America's mines in building up and restoring locomotive tires (illustrated), loading machine truck wheels, rock crusher heads, etc. They are also widely used for rail bonding, equipment repairs, general fabrication and structural welding.

AIRCO

Mine Production Records

Gas Welding and Brazing. Oxyacetylene gas welding and brazing have proved their worth in restoring to service broken parts such as the drive pinion (illustrated) when replacement has been difficult or impossible. Gas welding and brazing have also proved important aids in the construction of equipment and parts.



Machine Gas Cutting serves many purposes on mine properties. In the illustration, false and sharp flanges are quickly removed from mine locomotive wheels. With a special set up, Airco cutting machines are also used in trimming worn rails. Airco Radiagraph portable cutting machines are also useful for accurately cutting steel plate for applications such as car body repairs, car and locomotive parts, etc.

Hand Flame Cutting quickly restores worn equipment to service by speeding the removal of damaged parts. It is also useful for many small or occasional cutting jobs, for dismantling steel structures and for preparing scrap for shipment to the mills.

Hardfacing — the application of special alloys to wearing surfaces by the electric arc or oxyacetylene process—restores the usefulness and multiplies service life of many types of mining equipment such as drill bits, clam-shell and dipper bucket edges, crusher parts, etc.

OTHER AIRCO OXYACETYLENE AND ELECTRIC ARC PROCESSES SERVING THE MINING INDUSTRY

- Flame Cleaning of Steel Surfaces
- Flame Hardening
- Flame Heating for Straightening or Bending
- Oxygen Lancing
- Low Temperature Brazing
- Pipe Welding (Gas and Arc)
- Structural Welding
- Rail Bonding

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Export Sales Handled by Airco Export Corporation

MARCY *low* Discharge *lowers* per ton cost

Turns out more tonnage; improves metallurgy in all treatment following grinding.

The discharge opening of an open-end Marcy Mill is many times the discharge area of any conventional trunnion overflow mill . . . because the opening is the full perimeter of the grate. The finished product gets out of the mill without wasteful overgrinding and circulation of mill content is thus markedly increased.

In Marcy low discharge grinding the balls work on less pulp; ball cushioning is reduced; ball drop for impact is maximum; pulp density much higher. The end results are lower per ton cost, more tonnage and improved metallurgy.

New competitive conditions must be met with lower costs. The installation of Marcy Mills in your grinding circuit is one of the answers. Mine & Smelter engineers offer you 'a world of experience' without obligation.

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MEET A NEW AND DIFFERENT MAGAZINE

The job that SCIENCE ILLUSTRATED has set for itself has never been done before.

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SCIENCE ILLUSTRATED will *report, interpret,* and *project!* It will be fast and fascinating reading — a thrilling new magazine for an exciting new world! In its pages, month after month, the products, developments, and horizons of scientific achievement will come alive in terse, sparkling text and dramatic colorful pictures.

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Editor: Newspaper reporter, staff writer and, at one time, city editor for Associated Press in Chicago . . . formerly managing editor of Popular Mechanics . . . a writer with long experience in interpreting science for the lay reader.

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To bring you this month by month reporting of progress and achievement McGraw-Hill has assembled the finest talent available. Working hand in hand with the men pictured here is a top-flight staff of science writers, artists and photographers . . . men with long experience in making science *understandable* and *interesting*.

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N.B. to Advertisers: *What kind of an audience will be available to you in SCIENCE ILLUSTRATED? Obviously, an alert, intelligent, forward thinking group of people . . . the sort of people that are a step ahead of the parade in interests, desires and purchasing power. The initial print order will be 500,000 copies. Forms close on February 10th for the April issue. Write to SCIENCE ILLUSTRATED or telephone your nearest McGraw-Hill office for complete information.*

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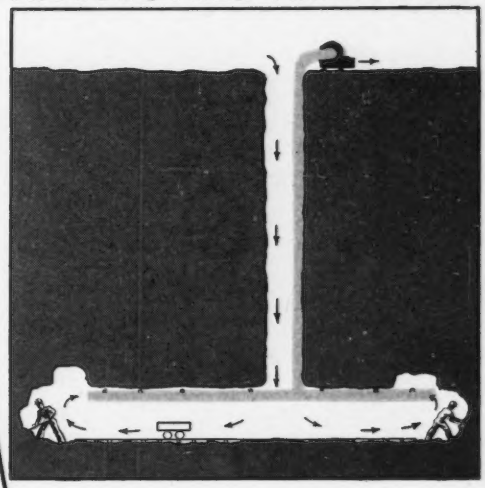

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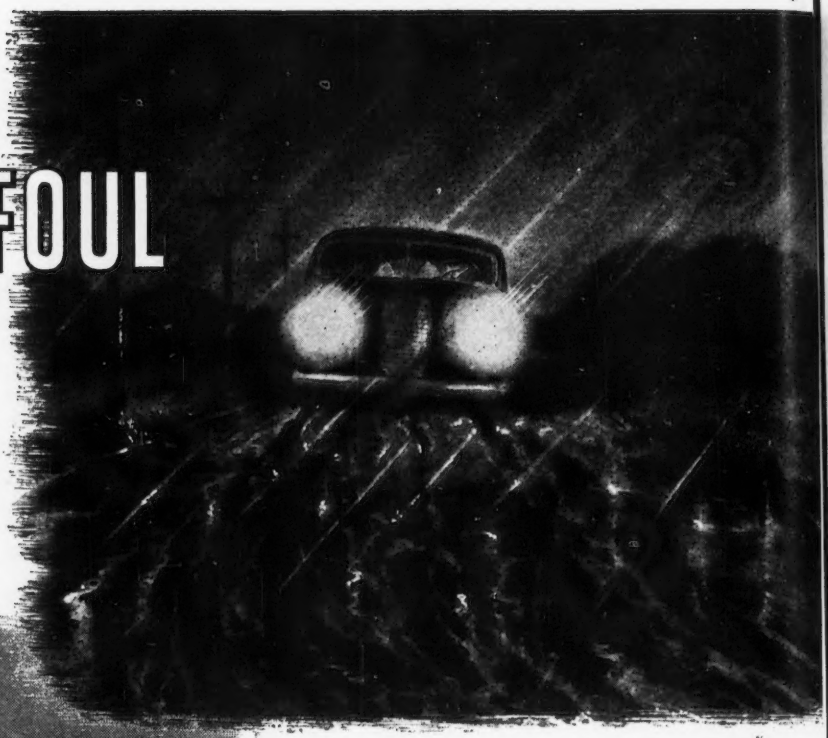

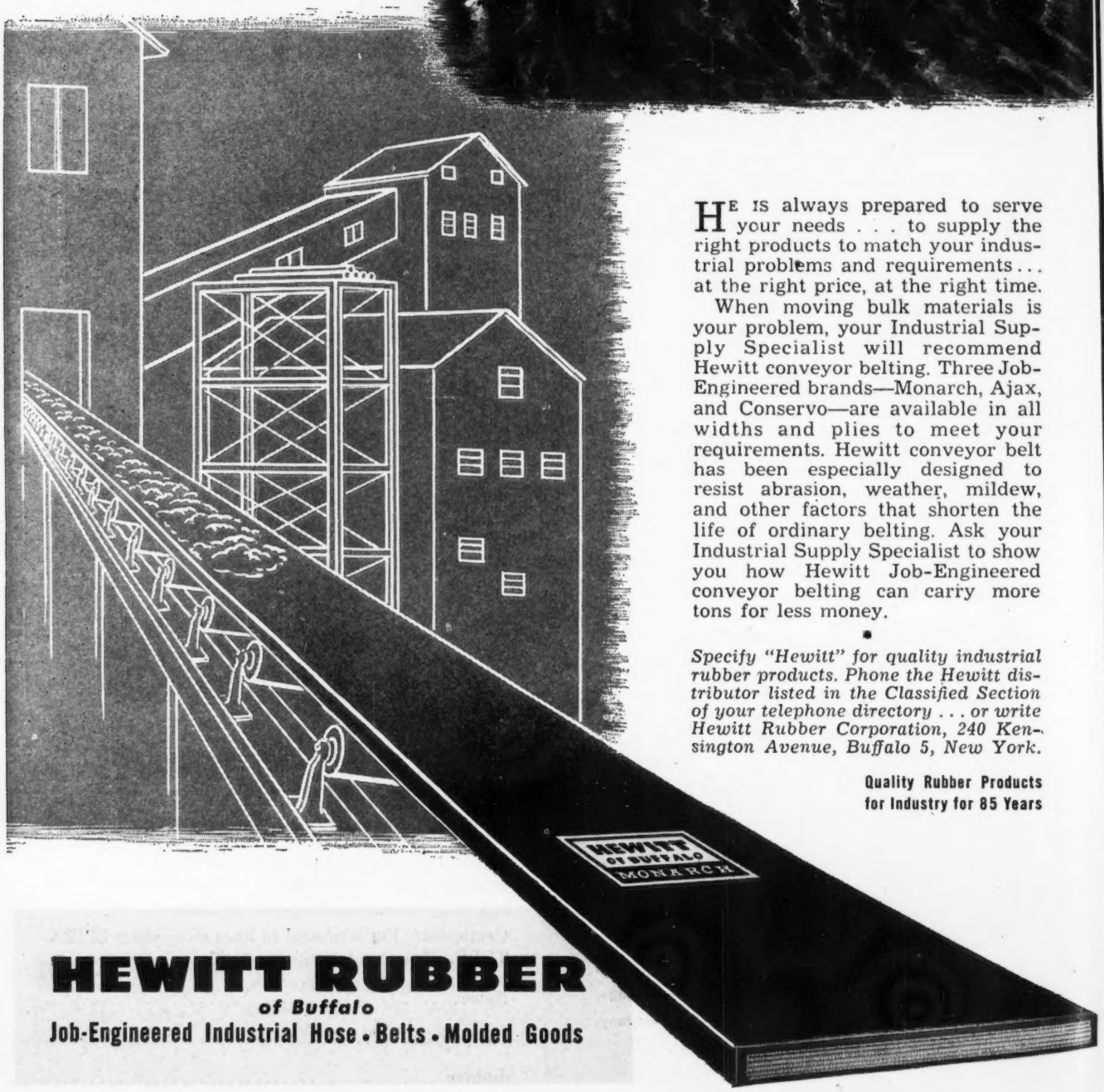

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When moving bulk materials is your problem, your Industrial Supply Specialist will recommend Hewitt conveyor belting. Three Job-Engineered brands—Monarch, Ajax, and Conservo—are available in all widths and plies to meet your requirements. Hewitt conveyor belt has been especially designed to resist abrasion, weather, mildew, and other factors that shorten the life of ordinary belting. Ask your Industrial Supply Specialist to show you how Hewitt Job-Engineered conveyor belting can carry more tons for less money.

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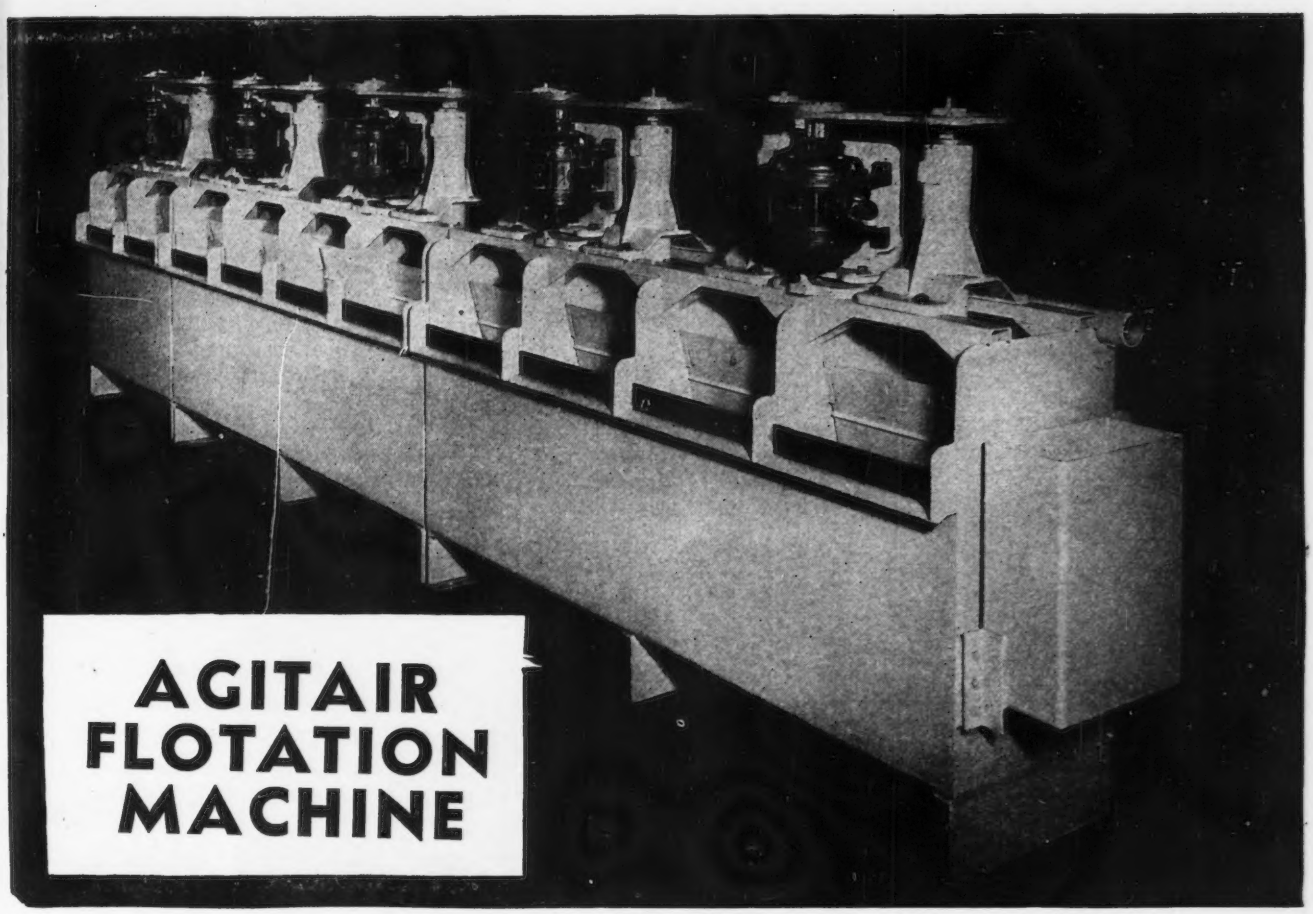

The famed **AGITAIR** Flotation Machine is scientifically adapted to both the job and the mill—most any separation job, most any mill. Its versatility meets fully the demands of metallurgy for a tested process of concentrating ore values. **AGITAIR** insures quick recovery—and quick recovery means greater profit. Its dependability and efficiency are known throughtout the world.

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Our FREE Bulletin 421 is a treatise on Flotation that belongs in the metallurgical engineer's library. Write for it.

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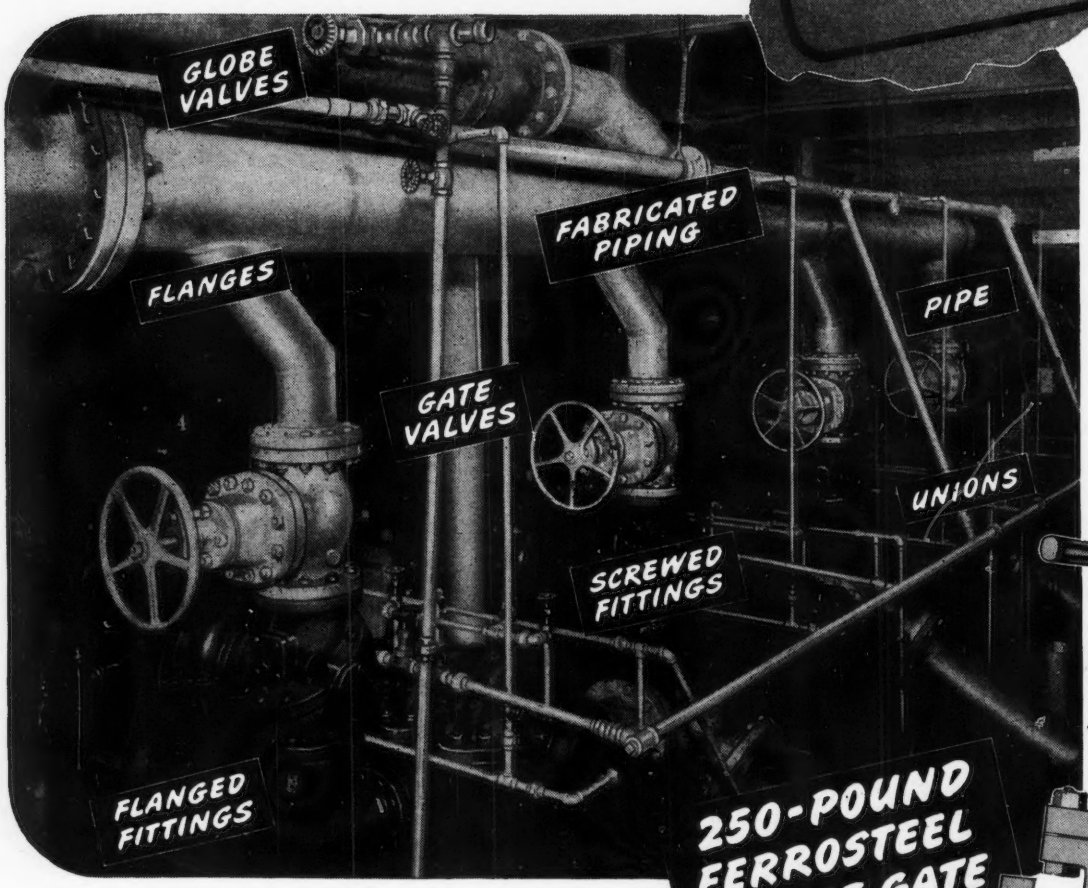
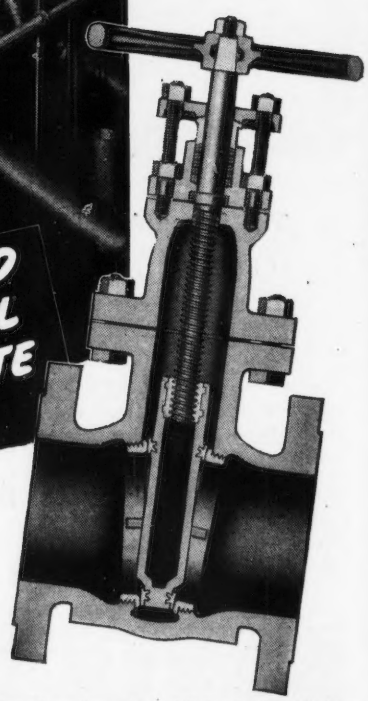


Pump room in a lead mine



250-POUND FERROSTEEL WEDGE GATE VALVES

SERVICE RECOMMENDATIONS:

Crane 250-pound Ferrosteel Wedge Gate Valves are recommended for services that are too severe for Standard Weight valves but where the use of steel valves is not required. Brass trimmed or all-iron. Working pressure ratings: 250 pounds steam; 500 pounds, cold. Ideal for oil, water, steam and other fluids that do not corrode brass or iron. Made in O.S.&Y. and in Non-Rising stem patterns; with flanged ends up to 12 in.; with screwed ends up to 4 in. Listed on pages 110 and 111 of your Crane Catalog.

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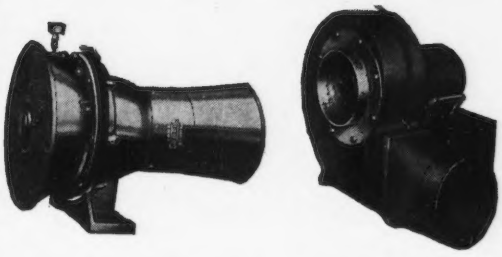
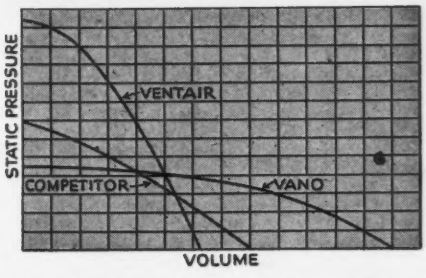
for given power consumption!



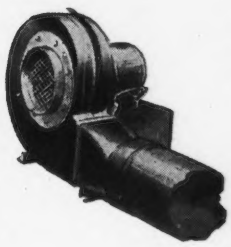
Only Coppus makes both types of mine ventilating fan — propeller (VANO) for medium pressures, short pipe lines, and centrifugal (VENT AIR) for high pressures, long pipe lines.



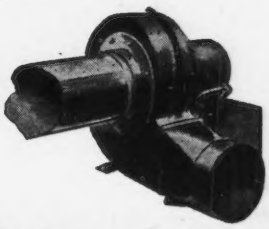
One or the other of the two Coppus fans, depending on length and diameter of ventilating line, will give you more air for a given power consumption than an all-purpose fan.

Coppus Mine Ventilation Blowers are portable — much lighter than other units. Capacities extend up to 90,000 c.f.m. (The blue band identifies Coppus workmanship and inspection).

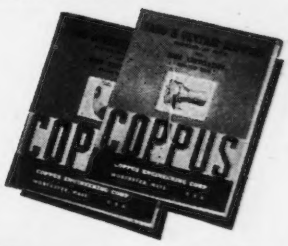
You have your choice of compressed air or electric motor drive. 21 cu. ft. of compressed air will give 1400 cu. ft. of ventilating air.



Coppus fan performs as blower, with pipe connected to diffuser outlet, or as exhauster, with pipe connected to inlet.



Write to Coppus Engineering Corporation, 312 Park Avenue, Worcester 2, Mass. for Bulletin 121-3 (compressed air driven) or 122-3 (electric motor driven)



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Representatives listed in METAL & NON-METALLIC MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers, and exhausters for special purposes. See also THOMAS' REGISTER.

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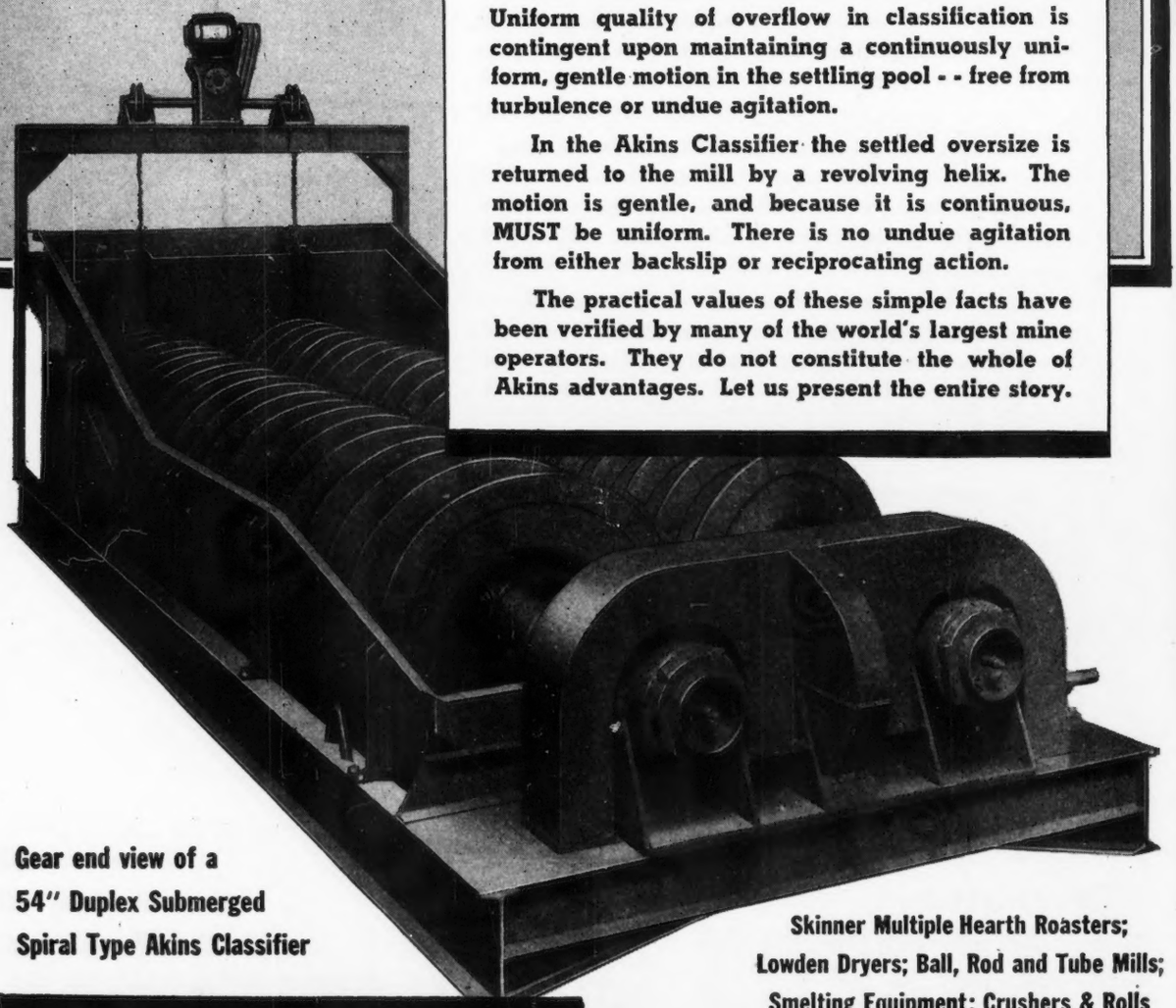
Uniform quality of overflow in classification is contingent upon maintaining a continuously uniform, gentle motion in the settling pool - - free from turbulence or undue agitation.

In the Akins Classifier the settled oversize is returned to the mill by a revolving helix. The motion is gentle, and because it is continuous, MUST be uniform. There is no undue agitation from either backslip or reciprocating action.

The practical values of these simple facts have been verified by many of the world's largest mine operators. They do not constitute the whole of Akins advantages. Let us present the entire story.



Gear end view of a 54" Duplex Submerged Spiral Type Akins Classifier

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The KVS Gearless Crusher
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—to develop big
—CRUSHING POWER
—because it has no
—POWER-EATING, RASPING GEARS
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—into CRUSHING POWER
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—LUBRICATION is another
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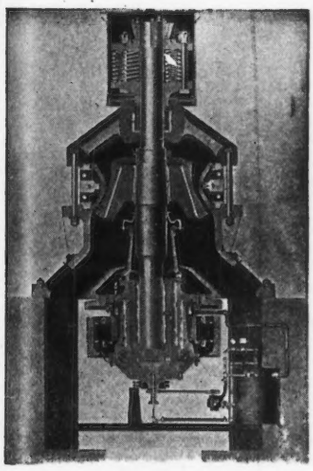
—the KVS will outcrush
—anything of similar size and h.p.!



Ball Bearing Gearless Type "S" Low-Head Crusher for fine crushing.

Ball Bearing Gearless Short Shaft Standard Crusher with synchronous motor built-in pulley.

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- CRUSHING POWER
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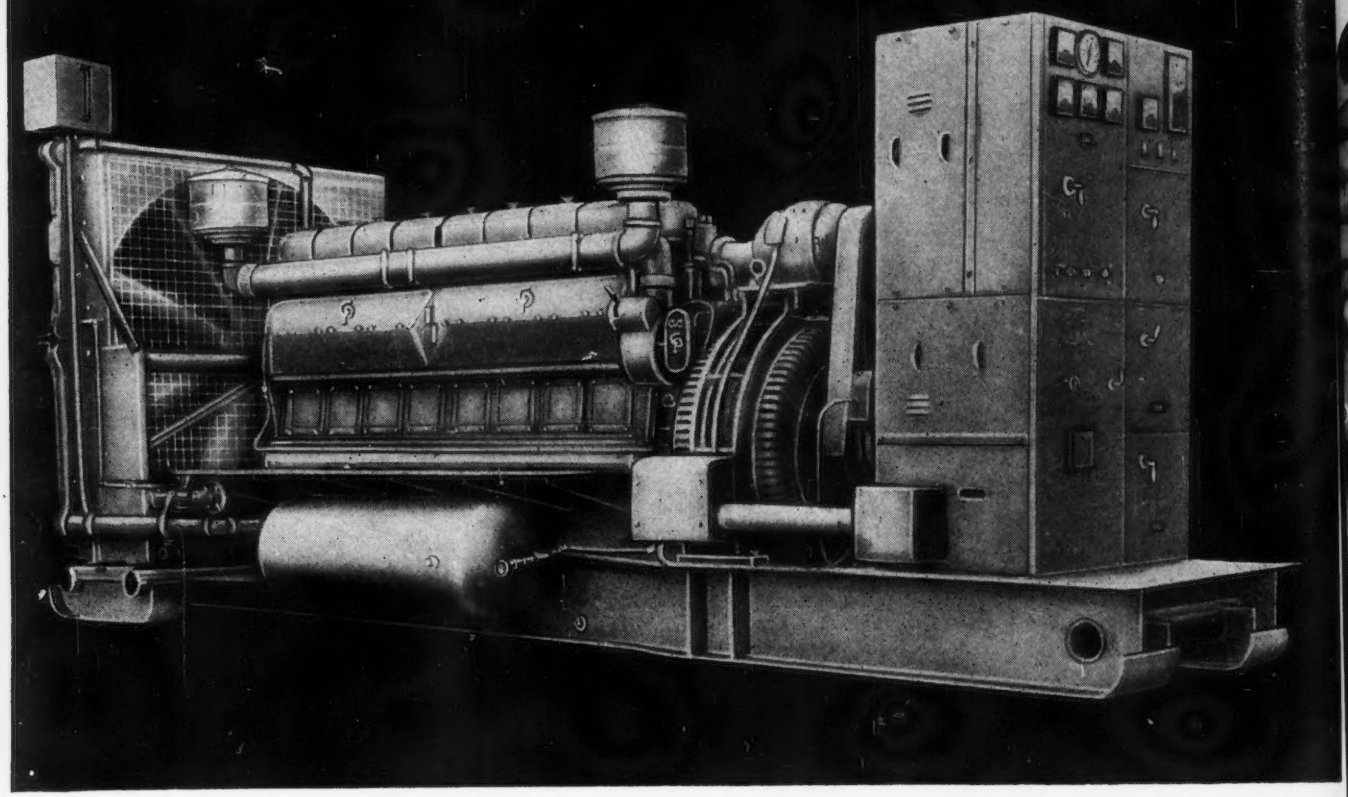

CP Diesel Electric Power Unit

READILY portable, CP Diesel Electric Power Units are furnished complete with all accessories — intake filter, exhaust silencer, starting air equipment, oil and water cooling equipment, switchboard, voltage regulator and wiring. Upon arrival at location and with minimum support these fully assembled CP Power Units are ready for immediate use.

Built in 100, 175 and 260 kw sizes, for any voltage and current characteristics, CP Diesel Electric Power Units are designed so that, where larger amounts of power are required, two or more CP units can be readily paralleled in multiple unit application. They are ideal for application in the petroleum, utility, contracting, mining and other fields where quick installations are essential. Write today for data on CP Diesel Electric Power Unit.

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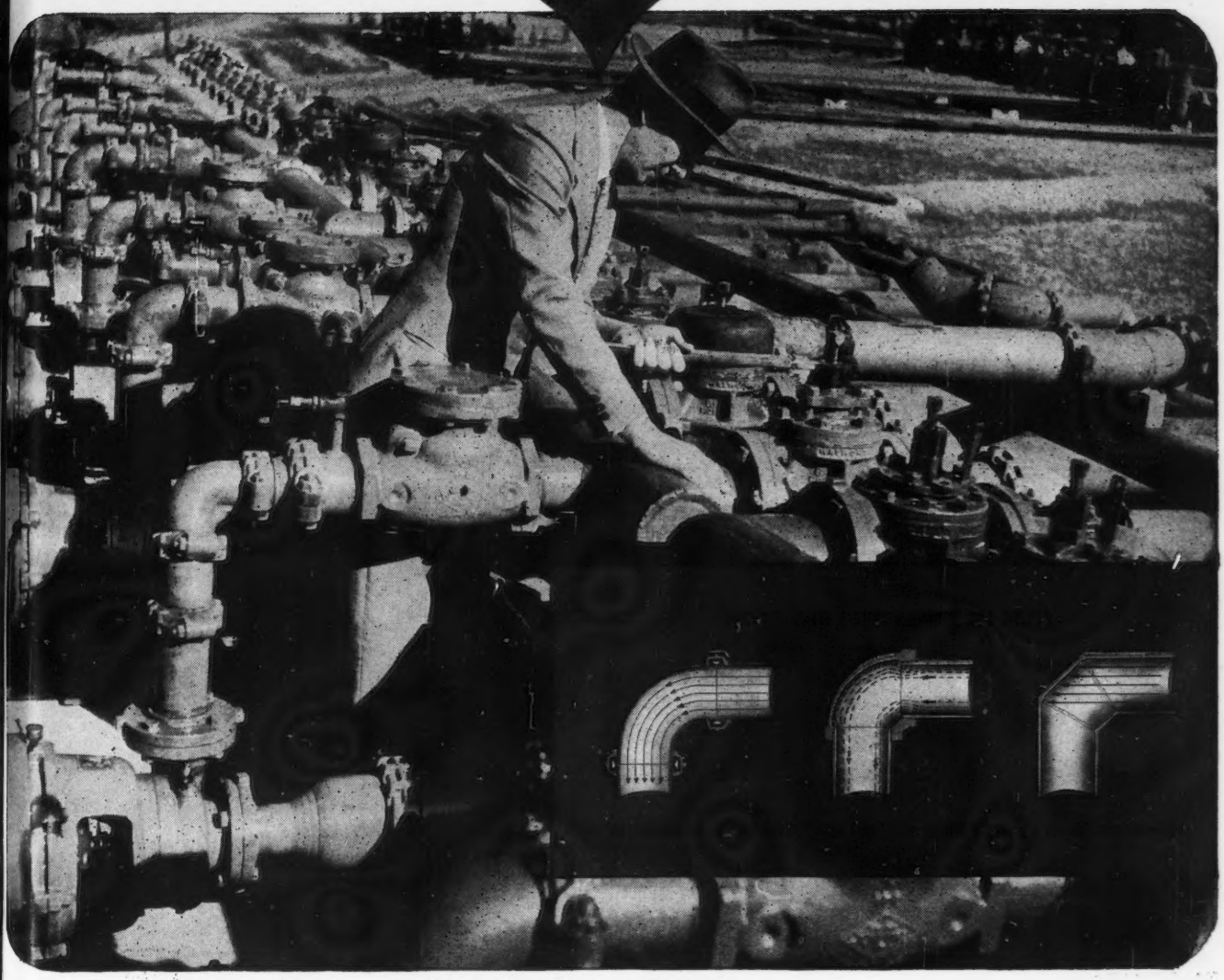


Victaulic Full-Flow Fittings and Couplings prove their greater economy at the Standard Terminal and Bulk Plant, Friendship, N. C.—Standard Oil Company (N.J.) photo.

Proved engineering design gives you increased pipeline delivery... lower pumping costs... with Victaulic Pipe Fittings.

Victaulics have long radii... wide, smooth sweeps! They have smooth, true-circular walls with *no internal projections*... no pockets! Victaulic Fittings feature an easy-fitting longitudinal tolerance plus an angular tolerance at each joint... and can be swiveled and set at any angle through 360°... acting in effect as swing joints. They can be independently removed from the line without disturbing the balance of the system.

What can these Victaulic Fitting features mean to you?

- **REDUCED FRICTIONAL LOSSES**
- **MORE EFFICIENT FLOW**
- **INCREASED PIPELINE DELIVERY**
- **LOWER PUMPING COSTS**

Write on your company letterhead for your free copy of the Victaulic Catalog and Engineering Manual. VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y. Other Victaulic Offices: Victaulic, Inc., 727 West 7th Street, Los Angeles 14, California; Victaulic Company of Canada, Ltd., 200 Bay Street, Toronto.

VICTAULIC

Reg. U. S. Pat. Off.

SELF-ALIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

Copyright, 1945, by Victaulic Co. of America

OIL MINING MARINE MUNICIPAL INDUSTRIAL

First WITH HYDRAULIC DRIVE

Joseph Keal, Rental Equipment Co., Missouri—Used a hydraulic drive Lorain 82 in gumbo and sand constantly for 4 years, says, "We have operated 7 makes of draglines and my honest opinion is that Lorain tops them all!"

La Clede Christy Brick Co., Missouri—At last report a year ago had piled up 8,000 hours in 2 years on a hydraulic drive L 82—4 years' work in 2—and still going as strong as ever.

Liberty Limestone, Virginia—Four years, 9 hours a day, 26 days a month—rock all the way—reports, "Simple, durable and satisfactory!" Has purchased a second L 82 to prove it!

LOOK AT THIS RECORD...

Contractors Service Corp., Pennsylvania—handled 3,000,000 tons of rock a year with 5 Lorain 82's—50,000 tons a month per shovel for 12 months straight!

...AND STILL FIRST AFTER 5 YEARS!

There's no substitute for experience! And today when hydraulic drive is just coming into its own in construction equipment, Thew—who pioneered it in the shovel and crane field—can offer you tested hydraulic coupling equipped machines with 5 years of tough concentrated field work behind them!

Here—in the 2-yard Lorain 82—is hydraulic drive at its peak. You can't shock this shovel. Slam the dipper into the pile or tie into the biggest rock and the Lorain-engineered hydraulic coupling absorbs shocks and strains—reduces maintenance by lengthening machinery life. Not only that! The power hangs on like a bulldog till the rock is in the dipper—the engine never stalls.

Hydraulic drive plus Thew Center-Drive direct-to-the-point turntable power application; two speed chain drive crawler; all-steel, all-welded boom; all-steel dipper stick and new, one-piece, streamlined dipper make the "82" ideal for rock and other tough work.

Hydraulic drive can save you plenty! Be sure you get it at its *tested* best—in a proven Lorain 82. Ask your Lorain distributor for details today.

HYDRAULIC DRIVE STANDARD ON ALL LORAIN 82's AT NO EXTRA COST

Reg. Trade Mark

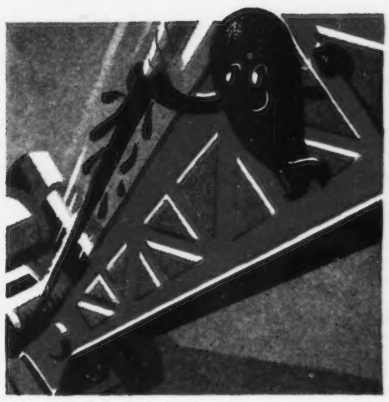
thew · Lorain

THE THEW SHOVEL COMPANY
LORAIN, OHIO

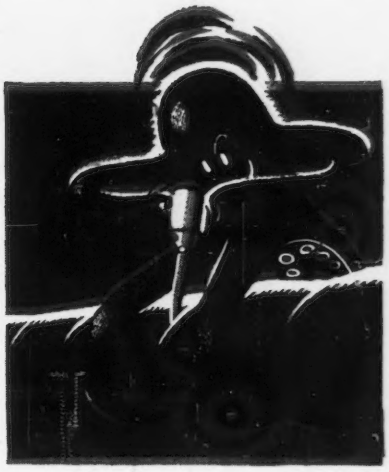
CRANES · SHOVELS · DRAGLINES · MOTO-CRANES

EASILY APPLIED COLD – STOPS WIRE ROPE WEAR

1. Your wire rope is a machine, composed of many working parts. It requires lubrication to reduce frictional wear. But the original factory lubrication will not last the life of the rope.

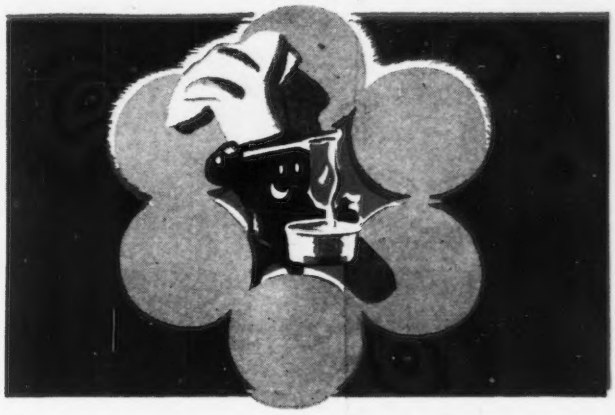


2. Field lubrication at regular intervals is essential. And the easiest, quickest, most dependable way to lubricate wire rope on the job is to use Unacal Cable Lubricant.



3. Unacal is a special blend of several ingredients carefully selected to give the utmost in lubrication, penetration, tenacity, and protection against rust and corrosion.

4. Because of a special solvent, it may be readily applied cold by paintbrush, drip can, or any other convenient method. Then Unacal quickly penetrates the rope, lubricating every strand.



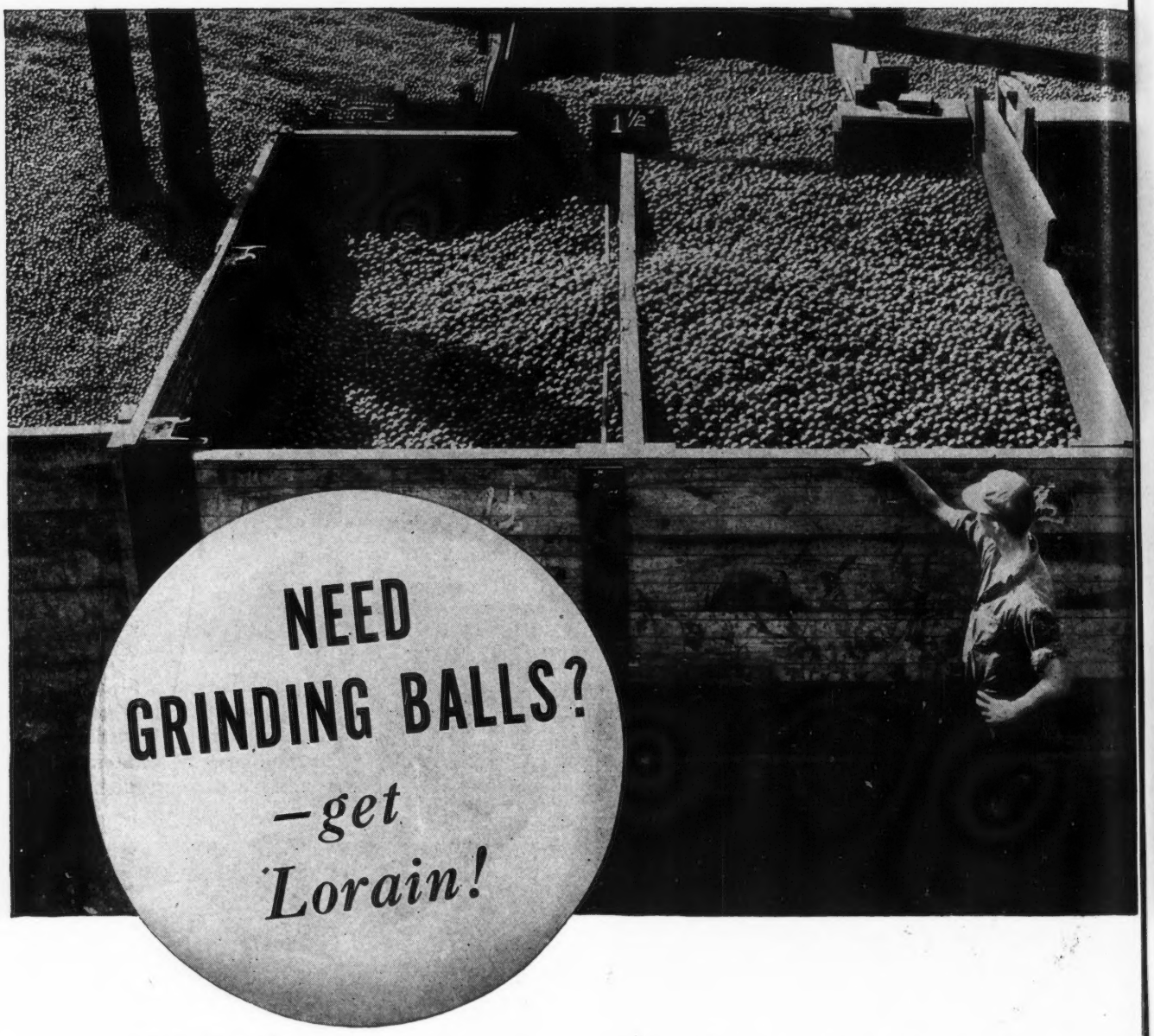
5. After the solvent evaporates, the oil supply *inside* the rope continues to feed the strands for a long time–sharply reducing internal friction that causes wire rope wear.

Try a supply of Unacal Cable Lubricant. Your Union oilman or Union Oil Company, Los Angeles 14, California – will gladly furnish more information and deliver a supply.

UNACAL CABLE LUBRICANT

UNION 76

Another **UNION OIL** *Success-Tested Product*



BETTER grinding, greater economy. That's what many of the biggest grinding plants report when U·S·S Lorain Grinding Balls are used in mills of all sizes.

Specially made—to definite specifications—for the grinding industry, they are used successfully in both preliminary and finish mills for all types of grinding. They are forged from new steel, accurately heat treated to stand abrasion and impact throughout long, heavy runs.

U·S·S Lorain Grinding Balls are tougher, harder, longer lasting.

When you need grinding balls, be sure to get complete information about U·S·S Lorain Grinding Balls.

USS STEEL
UNITED STATES STEEL

LORAIN GRINDING BALLS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago · Offices in Principal Cities

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

AT Nairobi, British East Africa, at Walla Walla, Washington, and more than 300 cities in between, owners of Hyster Tractor Equipment get quick and efficient service through "Caterpillar" distributors and dealers.

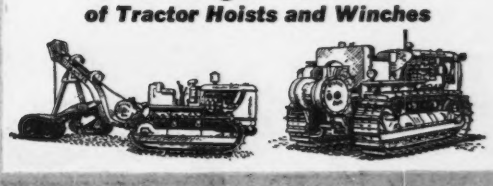
This 15-year-old program of globe-circling parts and mechanical maintenance service is predicated on two facts:

1. **Hyster Tractor Equipment is designed and manufactured for "Caterpillar" track-type tractors.**
2. **Every "Caterpillar" distributor or dealer is a Hyster dealer.**

When you buy a Hyster winch, yarder, logging arch, sulky or the new Hystaway, you have the assurance of friendly, intelligent cooperation on service as well as sales from men who know—"Caterpillar" distributors and dealers all over the world.

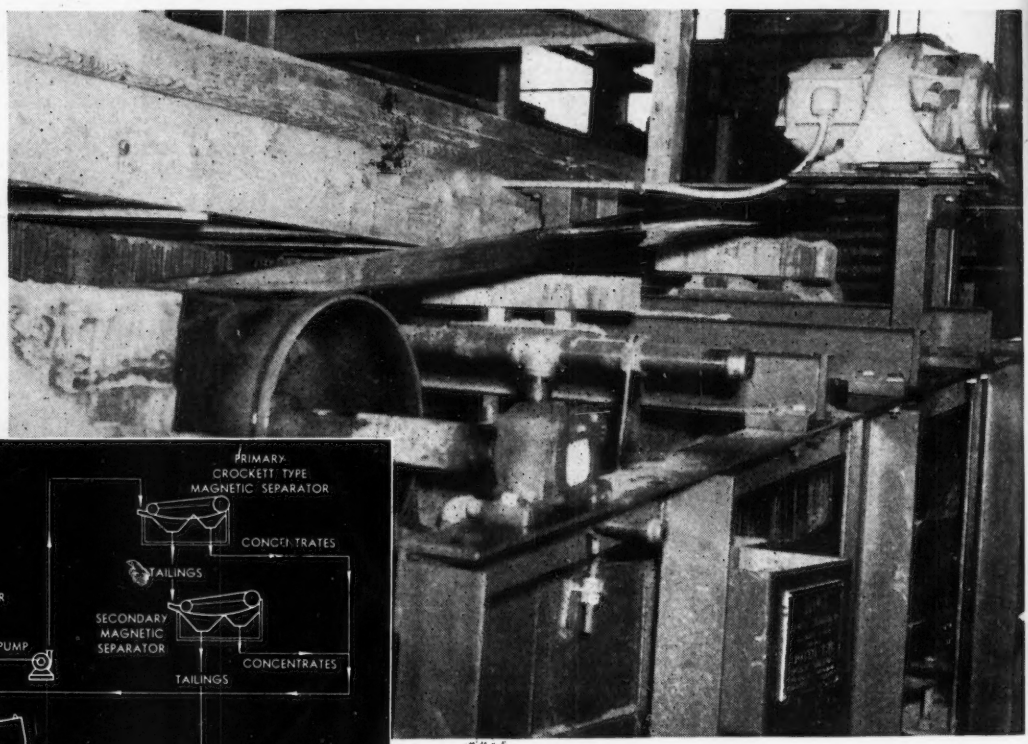
HYSTER
COMPANY
2908 N. E. Clackamas, Portland 8, Ore.
1808 N. Adams Street, Peoria 1, Illinois

World's Largest Manufacturer of Tractor Hoists and Winches

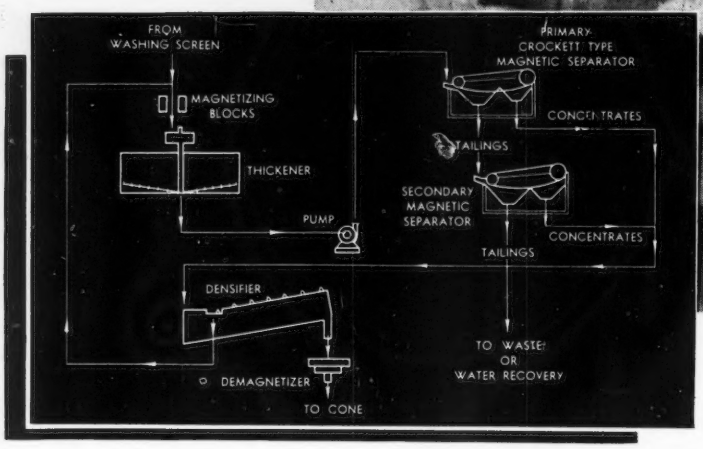


Recovery up to 99% in sink-float plants

- Separation
- Concentration
- Purification



A Dings Crockett Separator at work in a Colorado Sink-Float Mill.



A typical flow sheet, showing application of Dings Crockett Separators for medium cleaning in the sink-float process.

with Dings Crockett Separators!

REMARKABLY fine automatic control of the medium cleaning process in the highly successful sink-float process for the concentration of low grade ores is being achieved with Dings Crockett "High Intensity" Magnetic Separators. Regular run recoveries up to 99.9% have been reported! With such sharp separation ability, it is easy to understand why Dings Crockett Separators are the acknowledged preference for use in sink-float plants.

Other applications of Dings Crockett Separators cover a wide range of purifying, concentration, and separation jobs in modern ore dressing processes. If positively controlled magnetic separation might solve a problem for you, Dings Laboratories will be glad to make exhaustive tests on samples of your materials without cost or obligation. Send a 25-pound sample to Dings, stating the type and percentages of separation desired. A complete report will be made promptly.

Complete information on the Dings Crockett Separator is contained in Dings Catalog No. 550. Send for your copy today.

Dings MAGNETIC SEPARATION HIGH INTENSITY

DINGS MAGNETIC SEPARATOR CO.

526 E. SMITH STREET, MILWAUKEE 7, WISCONSIN

How We Keep A Fast Crowd In Line

Here's a *fast crowd* that doesn't give trouble--not the way P&H builds it!

It's plain to see why the crowding action of P&H Electric Shovels is so much livelier — more responsive and powerful. Conical worm gear drive cuts inertia to a minimum — permits the most compact gearing unit possible. Only very short shafting is required; overhung gearing is eliminated. Every ounce of power from the independent crowd motor flows smoothly to the dipper sticks for *snappier* crowding — *faster* retracting.

P&H engineers increase the advantages of the compact, flood-lubricated gear case design by building it integral with the boom. Welded-in construction adds to boom rigidity and strength, while integral shipper shaft housing prevents bearing movement and torque on the boom. The net result in any open-pit operation is bigger and steadier production.

This faster, more dependable crowd is another example of the advanced engineering and simplified design that mark the new P&H Electric Shovels as the greatest forward step in electric shovel history. Behind them is P&H's 60-year leadership in applying electrical power to the movement of heavy loads.

P&H

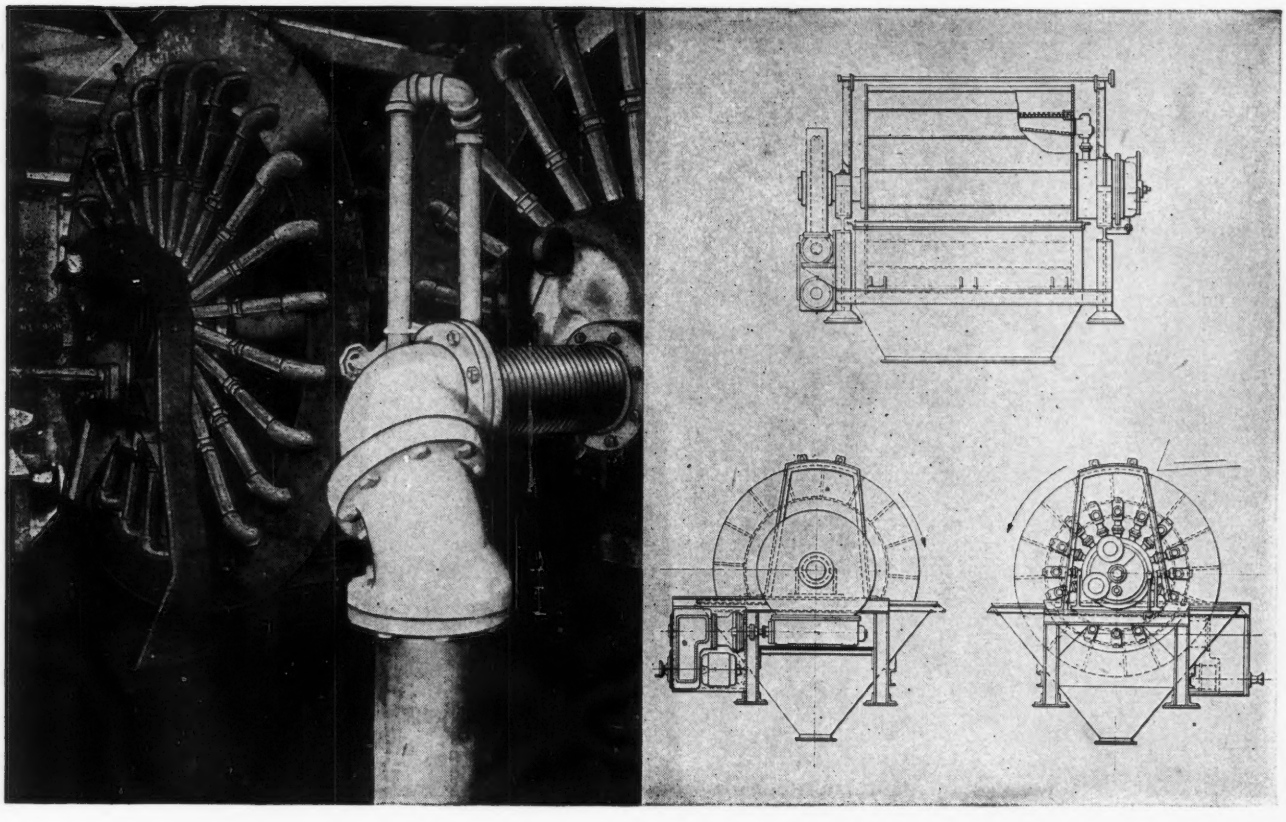
ELECTRIC SHOVELS

4454 W. National Avenue
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS • HOISTS • WELDING ELECTRODES • MOTORS

THE GREATEST FORWARD STEP EVER MADE IN ELECTRIC SHOVEL DEVELOPMENT



DESIGN ESTABLISHES NEW PERFORMANCE STANDARDS

By taking full advantage of the quick filtering characteristics, as well as the tendency toward segregation of the coarser and heavier solids, Conkey Rotary Hopper Vacuum Dewaterers provide low-cost operation for—

The filtration of coarse segregating solids

Dewatering of classifier oversize

The filtration of magnetic, table and flotation concentrates

Dewatering of light bulky solids

This improved design eliminates the necessity of adjusting feed consistency and provides long-time continuous automatic operation with practically no supervision.

Large capacity is secured by taking full advantage of the effect of classification, minimizing cloth blinding and operating with relative high drum speeds.

For example, in one installation, each Conkey Rotary Hopper Vacuum Dewaterer is dewatering over 2,000 tons of solids per day, to approximately 6% moisture.

Write today for the new bulletin outlining some of the distinctive features of these dewaterers.

GENERAL AMERICAN

TRANSPORTATION GATX **CORPORATION**

GENERAL AMERICAN

PROCESS EQUIPMENT DIVISION **PLATE & WELDING DIVISION**

General Sales Offices: 514b Graybar Bldg., New York 17, N. Y. • *Works:* Sharon, Pa., and Louisville, Ky.

Sales Offices: Chicago, Sharon, Louisville, Cleveland, Pittsburgh, St. Louis, Salt Lake City, San Francisco, Tampa, Washington, D. C.

OPPORTUNITY FOR MINE CAR DESIGNERS TO LENGTHEN SERVICE LIFE

That's one big reason why these low alloy, high tensile steels were developed—to help designers of mine equipment to increase car life in punishing service without any step-up in car deadweight.

And here is how it's done.

Republic High Strength Steels provide a minimum yield point of 50,000 pounds per square inch—are equal in abrasive resistance to carbon steels of like physical properties — resist atmospheric corrosion.

In mine cars this means greater strength, toughness and durability to resist rough usage. It means that cars stay out of repair shops years longer. It means savings in maintenance and replacement expense. And, where no more payload is desired, you can design cars of lighter weight without any reduction in life expectancy.

So that designers and builders may realize greatest benefits, Republic produces three high strength steels —Republic ALDECOR, Republic COR-TEN and Republic DOUBLE STRENGTH in bars, plates, sheets, and strip. Although similar in physical properties, certain differences in forming and welding characteristics may make one more suitable for you than the other two.

Republic's metallurgical staff is ready now to work with you in determining how best to apply these steels to your equipment. Write us.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N. Y.

Republic
HIGH STRENGTH STEELS
ALDECOR • COR-TEN • DOUBLE STRENGTH

Other Republic Products include Carbon, Alloy and Stainless Steels — Sheets — Plates — Pipe — Bars — Wire — Bolts, Nuts and Rivets

WALWORTH LUBRICATED PLUG VALVES

offer these advantages

- . . . Direct port opening
- . . . Quarter turn opens or closes valve
- . . . Dead tight shut-off
- . . . Freedom from attack by fluids being handled
- . . . Pressure sealed
- . . . Made in a complete line. Sizes from ½" to 24" for pressures from 125 to 5,000 psi., and for vacuum requirements

THESE are just a few of the reasons why Walworth Lubricated Plug Valves give "top" performance on many *difficult* services.

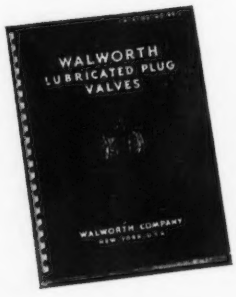
All Walworth Lubricated Plug Valves employ special insoluble lubricants which protect the plug and body against contact with the line fluid, thus combatting erosion and corrosion.

The lapped surfaces of the valve are "pressure sealed" when the valve is in either the open or closed position. By turning the lubricant screw, lubricant is forced under high pressure through a grooving system that completely encircles the parts as well as the top and bottom of the plug.

The lubricant seals the valve against leakage, and reduces friction between plug and body. This permits easy, quick, full-opening, or tight shut-off with only a quarter turn of the plug.

Fig. 1700 (illustrated) is a Steeliron valve, wrench operated, designed for a working pressure of 200 pounds WOG (water, oil, or gas). Valves are available in either screwed or flange types. Screwed type have API line pipe thread lengths. Flanged type are faced and drilled to American Standard for 125-pound cast iron flanges unless otherwise specified.

For further information about Fig. 1700, as well as the complete line of Walworth Lubricated Plug Valves write for Catalog No. 44L.



SEND FOR THIS FREE CATALOG

This new Walworth Lubricated Plug Valve Catalog No. 44L is just off the press. It gives prices, sizes, dimensions, and other pertinent data on this comprehensive line. A request on your company's letterhead will bring you a free copy of this informative catalog.

ARMY (E) NAVY
14 AWARDS TO 4 PLANTS

WALWORTH
valves and fittings
60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

PENTASOL AMYL XANTHATE Z-6

* . . . increases recoveries from ores already yielding good percentages.

* The great collecting power of Pentasol Amyl Xanthate—made from a blend of 5 Sharples Amyl Alcohols (mining grade)—enables many strategic mills to rework old tailing dumps and recover important values from ores formerly too costly to work. Why not make a test run with this powerful collector? The commercial product is Bear Brand Z-6, manufactured by Great Western Division, The Dow Chemical Company. Samples will be sent to you on request.

SHARPLES CHEMICALS INC.

PHILADELPHIA CHICAGO NEW YORK

SHARPLES TRADE MARK CHEMICALS

"TOUGH" HANDLING JOBS MADE EASY WITH LINK-BELT CONVEYORS

14-ton load of limestone, ready for dumping into receiving hopper of inclined Link-Belt apron conveyor feeding the primary crusher, located nearby on quarry floor.

● Here's an excellent example of solving a "tough" handling job at the Warner Co.'s Cedar Hollow plant. The problem was how to get enormous lumps of limestone blasted from quarry face, into primary crusher at a uniform rate, with prompt release of quarry trucks, and without choking or stalling the crusher. Link-Belt engineers worked out a system and installed a specially designed apron conveyor, 5-ft. wide and 60-ft. centers, inclined 25° from horizontal, with a capacity of 300 T.P.H. The hopper was built to withstand the terrific impact of 14 tons of rock dumped from truck. Lumps measuring 4 to 6 ft. across and weighing 2½ tons are handled. Crushed stone is fed uniformly by a reciprocating feeder to a belt conveyor extending to secondary crusher.

Check your materials handling and power transmission machinery plans with Link-Belt engineers.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices in principal cities.

Illustrating conveyor apron, bottom of truck dump hopper, and the takeup bearings which support the conveyor foot shaft.

View of fully loaded Link-Belt apron conveyor from truck dump hopper to primary crusher. Large lump in foreground measured 6-ft. across. In background is inclined belt conveyor delivering crushed stone to secondary crusher.

LINK-BELT CONVEYORS

PREPARATION EQUIPMENT . . . POWER TRANSMISSION MACHINERY

OTHER LINK-BELT EQUIPMENT INCLUDES: Complete Sand, Gravel and Stone Washing Plants . . . Ready-Mixed Concrete Plant Equipment . . . Lime Handling Equipment . . . Screens (vibrating, rotary and conical) . . . Washers and Classifiers of the screw, log, flight, Shaw and conical types . . . Dewatering Rotoscoops and Screw Conveyors . . . All Types of Elevators and Conveyors . . . Roto-Louvre Dryers and Coolers . . . Skip Hoists . . . Car Spotters . . . Portable Conveyors and Bucket Loaders . . . Silent and Roller Chain Drives . . . Speed Reducers . . . Variable Speed Transmissions . . . Chains (Malleable Iron, Promal and Steel) . . . Sprockets . . . Elevator Buckets . . . Gears . . . Clutches . . . Couplings . . . Self-Aligning Ball and Roller Bearing Units . . . Babbitted Bearing Units, etc. Catalogs on request. 9907

with anthracite's most Powerful Electric Hoist

. . . 93 trips per hour to surface 420 tons of coal—*that's real production!* And that's the everyday record for this Westinghouse powered and controlled mine hoist—the most powerful in the anthracite field.

It takes a lot of horsepower to do a job like this—1750 in fact—supplied by this powerful pedestal-type, wound-rotor Westinghouse induction motor. Operating on 2200-volt, 3-phase, 25 cycle power, the motor drives a large gear unit, connected to a conical drum carrying the 1700 ft. of 1⅝" steel cable used to raise and lower the cages.

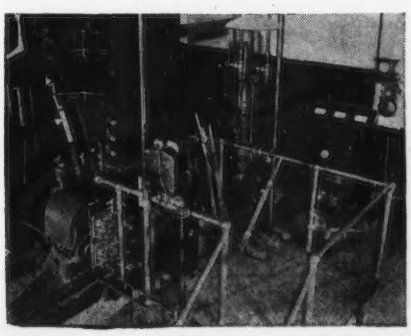
This hoist replaces an old 30 x 60 steam unit—and provides faster and more economical hoisting.

Conditions surrounding this installation were such that the purchase of low-cost, highly efficient alternating current equipment was recommended by Westinghouse engineers after a study of the requirements.

This is just another example of the ability of Westinghouse to solve the toughest mining problems. For a simple solution to your complex electrical problems, call your nearest Westinghouse Office. Westinghouse Electric Corp. P. O. Box 868, Pittsburgh 30, Pa.

J-94643

This 90-page booklet gives complete information on how to select electric hoist equipment to meet your special requirements. Write for free copy of B-3055 today.



CONTROL STATION—Primary hoist control is furnished by electro-pneumatically operated contactors. Secondary control gives 10-point acceleration through adjustable relays of the definite time-limit inductive type, operating on the last seven contactors. The first three points are under manual control. An electro-pneumatically operated air-brake contactor provides for reversal on the 2200-volt circuit.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

ELECTRICAL EQUIPMENT FOR THE MINING INDUSTRY

Flexible Tubing Helps Boost Job-Efficiency

By **W. E. BROWN**, *E. I. du Pont de Nemours & Co. (Inc.)*

Member, American Institute of Mining and Metallurgical Engineers

MEN working in properly ventilated areas can do a better, more efficient job. To provide them with better ventilation, more and more operators are using flexible tubing attached to an approved blower. Such a tubing is Du Pont "Ventube"* rubberized ventilating duct.

With "Ventube" on the job, workers are assured a continuous supply of fresh, cool air at the face. And output is directly affected. By quickly clearing the face after blasting, "Ventube" speeds the production cycle—workers can get back on the job in less time.

In contrast to rigid tubing, "Ventube" is easy to carry. One man can handle 100 feet at a time. Special patented couplings facilitate installation. Suspended on wire, "Ventube" passes over ground obstacles, men and machinery. Workers find that "Ventube" can be quickly extended as the face advances, and are encouraged to maintain adequate ventilation at all times; for example, when driving drifts and crosscuts, sinking shafts and winzes, caving and top-slicing. In addition, flexible "Ventube" bends around corners, takes up less space in openings.

Hung on messenger wire, "Ventube" is out of the way of men and machinery.

Between installations, "Ventube" is easy to pack and store. And this flexible tubing takes rugged wear. Chemically impregnated and coated, it resists abrasion, heat, moisture, acid and alkaline waters. If damaged, it's as easy to patch as an inner tube.

• • •

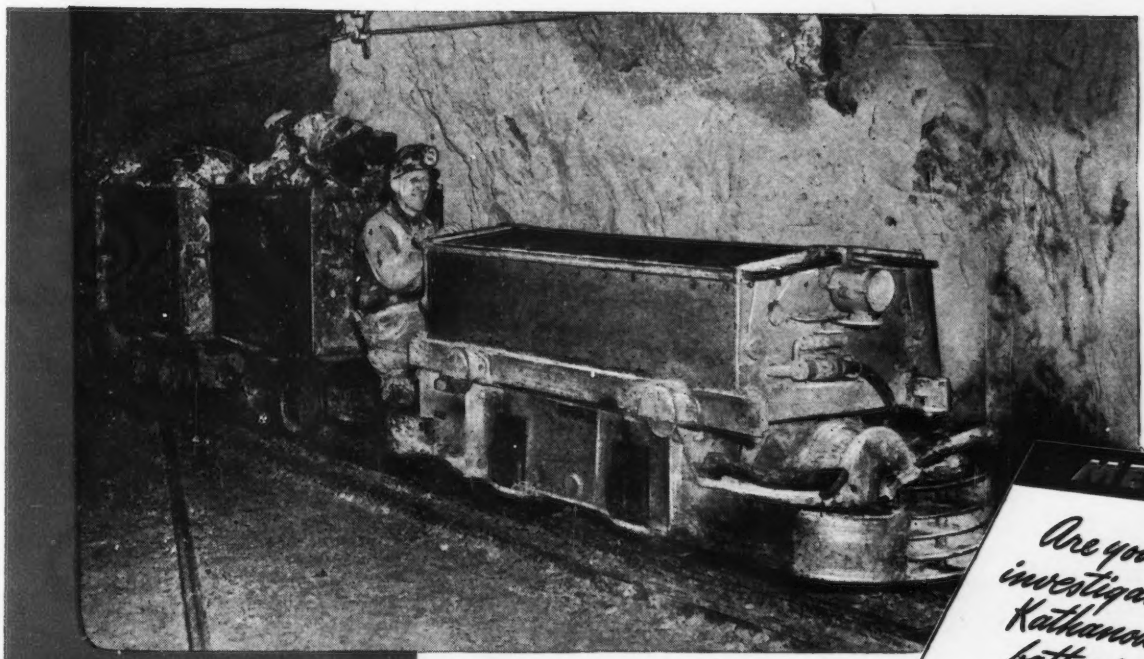
TIME-SAVING and work-speeding "Ventube" comes in standard sections of 25, 50, and 100 feet. Diameters measure 8, 12, 16, 20 and 24 inches. Sizes up to 36 inches can be made to order. A Du Pont Technical Service man will gladly discuss ways in which "Ventube" can make your mining operations more efficient and profitable. For further information, just write E. I. du Pont de Nemours & Co. (Inc.), Fabrics Division, Fairfield, Conn.

*REG. U. S. PAT. OFF.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

KEEP BUYING BONDS—HOLD 'TIL MATURITY



MEMO

Are you investigating Kathanode batteries?

GENERAL MANAGER

ARE YOU HAULING

MAXIMUM TONNAGE?

Gould Kathanode power gives your mine locomotives extra flexibility. It has high current output to get heavily loaded trains under way and sustained voltage for fast runs to and from the tipple.

Gould Kathanode batteries meet extra power demands. One reason is the special design of the positive grid. Among other features this has double-wedge-type members. There is ample cross-section for conductivity, yet only a knife-like edge is exposed. Peroxidization cannot reduce battery efficiency prematurely.

Investigate Gould power for your mine locomotives. Write Dept. 1412 for Catalog 200 on Gould Kathanode Glassklad Batteries for Mine Locomotive Service.

KATHANODE GRID
Cast to a special design, the Kathanode grid retains its power-conducting capacity for the entire service life of the battery.

GOULD STORAGE BATTERY CORPORATION, Depew, N. Y.

Factories: Atlanta • Boston • Chicago Dallas • Depew • Leavenworth • Los Angeles • North Bergen • Rock Island Saint Paul • Salem • Sioux City Zanesville

GOULD

KATHANODE

ANTI-FRICTION BEARINGS

A good feature to have in a SHOVEL CRANE or DRAGLINE!

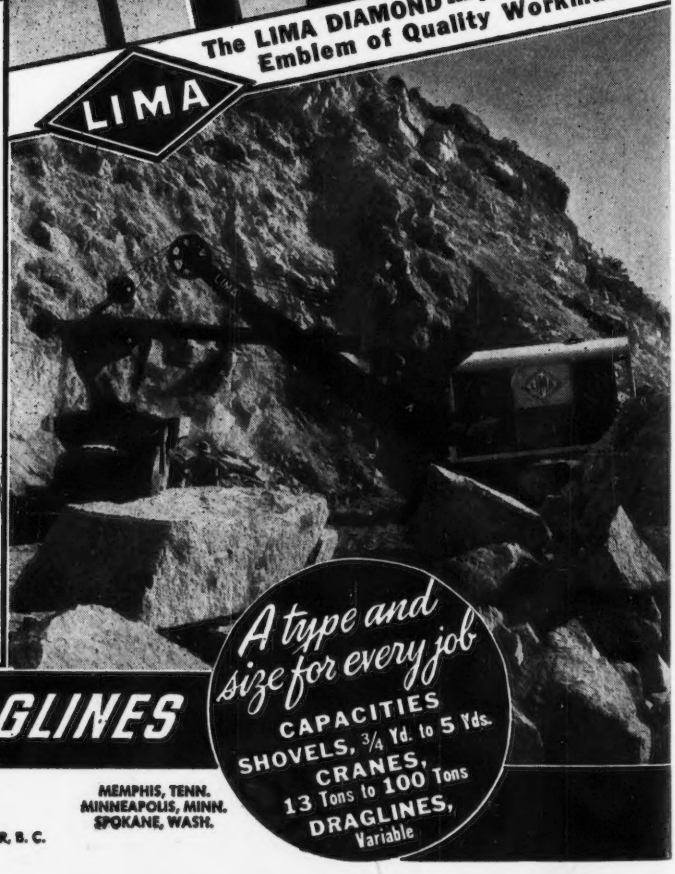
To get the full advantage of anti-friction bearings in a shovel, crane or dragline, the bearings must be applied to every important bearing point, not only on high speed shafts. Anti-friction bearings are the modern means of reducing friction. They transfer the sliding rubbing friction of a journal bearing into a rolling friction. A good demonstration of the difference may be had by first rubbing the palms of your hands together, noticing how warm they get, then take a round pencil or marble, and rolling it between the palms. Rolling motion starts easier than the sliding motion, therefore, less strains are imposed upon the various parts of the machine. In addition to effecting less bearing friction, anti-friction bearings also save oil, grease and fuel consumed by the engine, and that's not all -- anti-friction bearings, when applied to the drums (as they are in a LIMA), hold the drums concentric to their clutch and brake, consequently the clutch and brake action is smooth - no chattering and grabbing. Remember, the more precise the machine the better the performance and the longer its life.

LIMA LOCOMOTIVE WORKS, INCORPORATED
SHOVEL AND CRANE DIVISION — LIMA, OHIO, U. S. A.

Various Types of Bearings used in LIMA Shovels, Cranes and Draglines

LIMA

The LIMA DIAMOND --- For 75 Years an Emblem of Quality Workmanship



A type and size for every job
CAPACITIES
SHOVELS, 3/4 Yd. to 5 Yds.
CRANES, 13 Tons to 100 Tons
DRAGLINES, Variable

SHOVELS • CRANES • DRAGLINES

NEW YORK, N. Y. · ST. LOUIS, MO. · SAN FRANCISCO, CALIF. · CHICAGO, ILL. · DALLAS, TEXAS · SEATTLE, WASH. · MONTREAL, QUEBEC, CAN. · NEWARK, N. J. · PORTLAND, OREGON · LOS ANGELES, CALIF. · VANCOUVER, B. C. · MEMPHIS, TENN. · MINNEAPOLIS, MINN. · SPOKANE, WASH.

"PENNSYLVANIA"

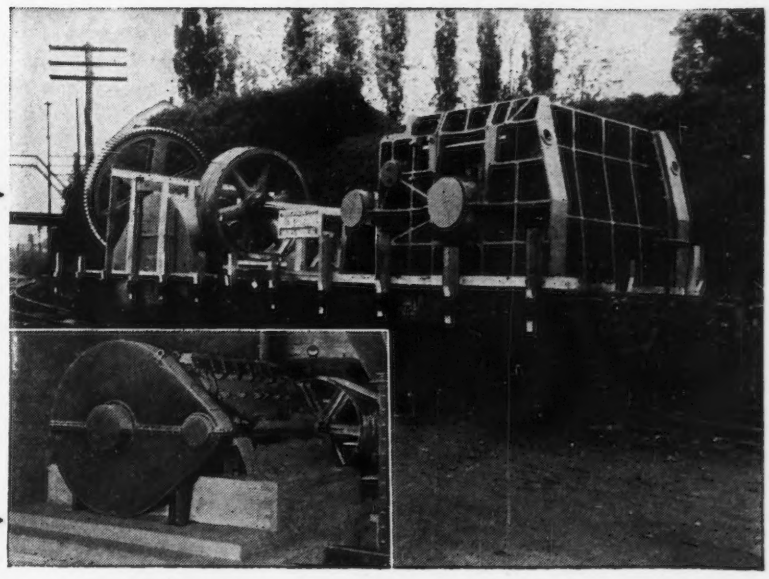
PENN-LEHIGH PRIMARY SINGLE ROLL CRUSHERS

Massively STEELBUILT,—with wide reduction ratios,—PENN-LEHIGH Single Rolls are specially adapted for primary non-clog crushing of heavy Steam Shovel feeds of Metalliferous Ores, Industrial Minerals and Cement-making Materials,—dry or wet. Six sizes,—capacity ranges 200-1000 tons hourly.

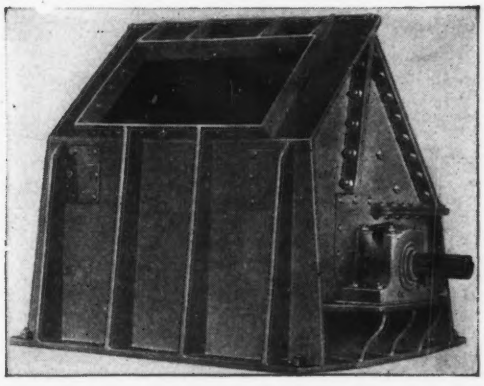
SUPER-PENNSTEEL SINGLE ROLLS

are specialized for making wide ratio *secondary* reductions of the above materials.

One-piece Steel frames,—Automatic Tramp Iron Protection. Three sizes,—capacity range 150-600 tons hourly.



The PENN-LEHIGH Primary (above) will duplicate user's 1928 installation, which has required no repairs during 16 years of crushing 2½ yard Shovel feed.



"PENNSYLVANIA" DOUBLE REDUCTION IMPACTOR

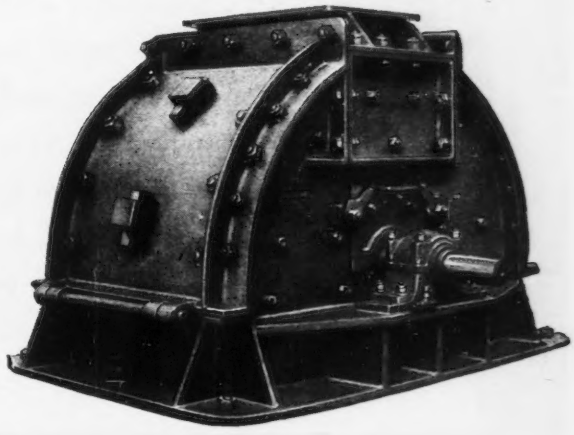
"PENNSYLVANIA" DOUBLE REDUCTION IMPACTORS

are powerfully STEELBUILT, for reducing Ores, Minerals and Rock from sizes ranging up to "one-man" size,—to products efficient for Ball-milling, small Aggregate, Road Chips, etc.,—2 crushers in 1,—which saves floor space, conveying machinery, and power. Six sizes,—capacity range 100 to 400 tons hourly. Patented.

"PENNSYLVANIA" REVERSIBLE IMPACTORS

crush by smashing impact, Metalliferous Ores, Refractories, Electric Furnace Products, and a wide range of Industrial Minerals, to roughly cubical products, with minimum dusty fines, which are "premium" for Ball-milling, bonding, and other processing,—in sharp contrast to earlier types. Patented. Twelve sizes,—capacity range 500 pounds to 400 tons hourly.

Our Laboratory Tests closely approximate results from regular operation.



Our Engineers are at your service.

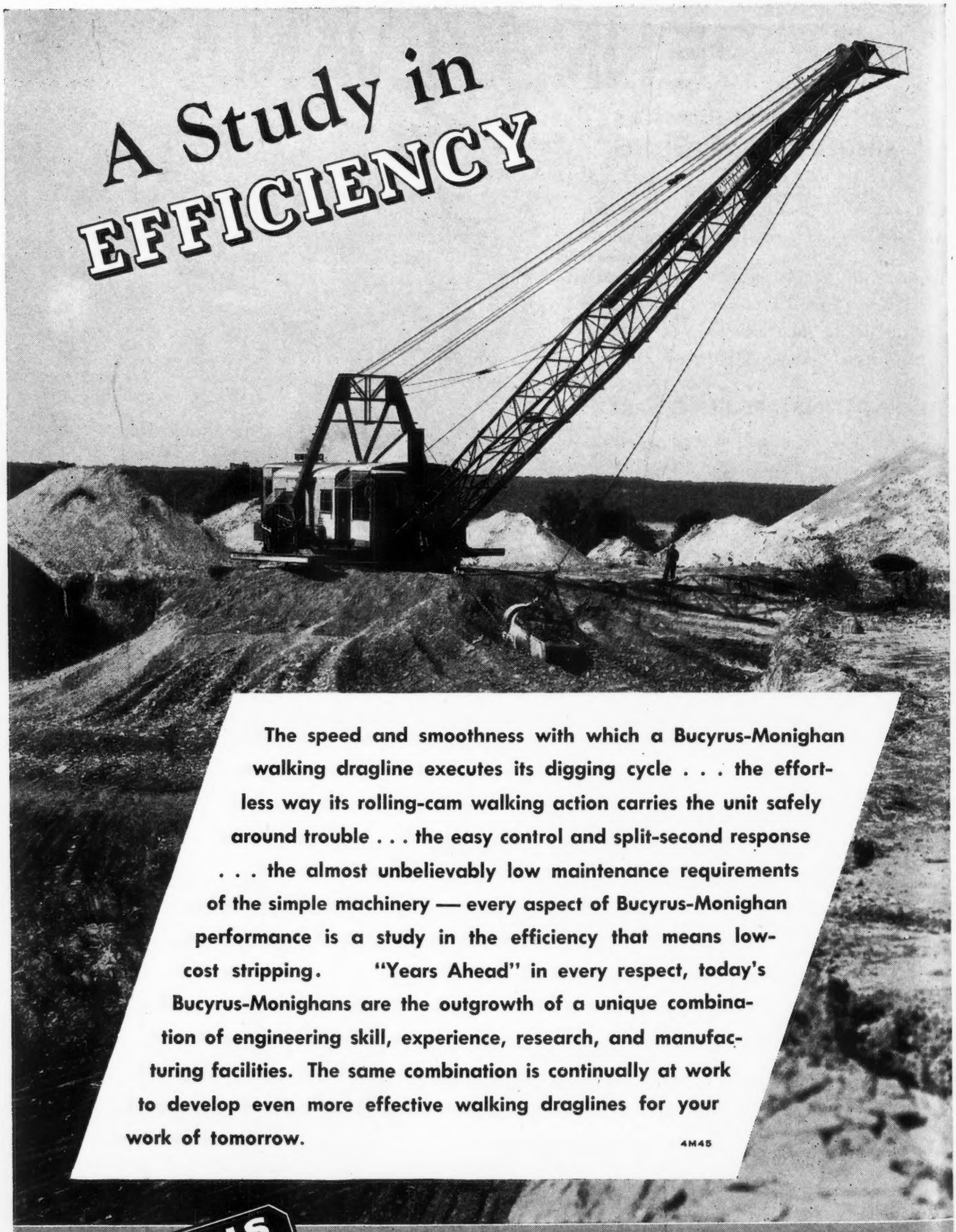
New York, Pittsburgh, Chicago, Los Angeles, Birmingham

PENNSYLVANIA CRUSHER COMPANY

Associated with Fraser & Chalmers Engineering Works, London

1700 Liberty Trust Bldg., Philadelphia 7, Pennsylvania

STEELBUILT CRUSHERS



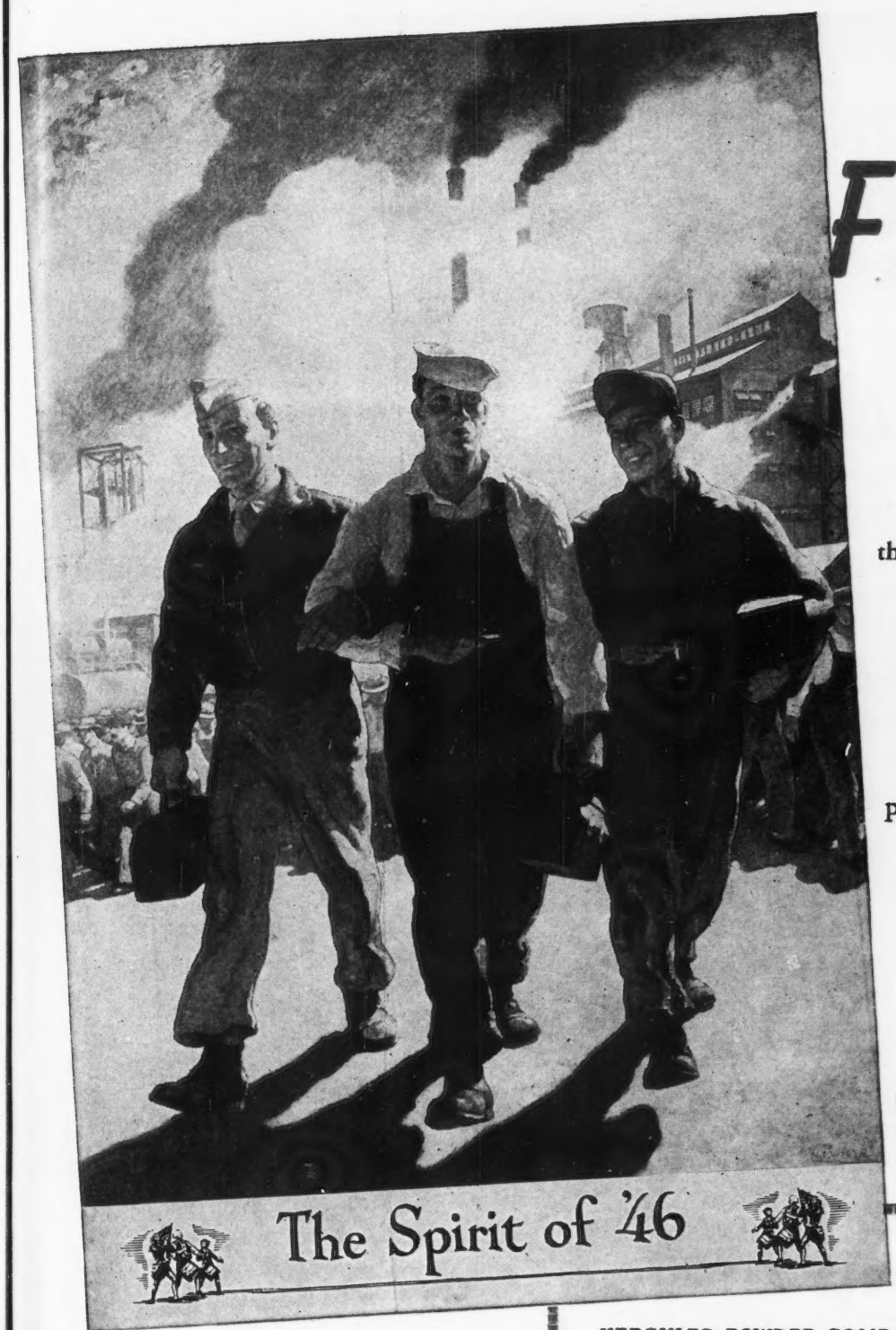
The speed and smoothness with which a Bucyrus-Monighan walking dragline executes its digging cycle . . . the effortless way its rolling-cam walking action carries the unit safely around trouble . . . the easy control and split-second response . . . the almost unbelievably low maintenance requirements of the simple machinery — every aspect of Bucyrus-Monighan performance is a study in the efficiency that means low-cost stripping. "Years Ahead" in every respect, today's Bucyrus-Monighans are the outgrowth of a unique combination of engineering skill, experience, research, and manufacturing facilities. The same combination is continually at work to develop even more effective walking draglines for your work of tomorrow.

4M45

BUCYRUS MONIGHAN

sold by BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



FREE!

This beautiful, full-color poster, painted by the well-known illustrator, N. C. Wyeth, is yours for the asking. Printed on heavy paper, size 27½" x 43½", this attention-compelling poster is ideally suited for posting in industrial plants and offices.

RETURN COUPON FOR YOUR COPIES NOW!

HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

HERCULES POWDER COMPANY INCORPORATED *933 King St., Wilmington 99, Del.*

Please send me..... copies of your poster THE SPIRIT OF '46. I understand that this places me under no obligation whatsoever.

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IN-223

The belt that leads a DOUBLE LIFE

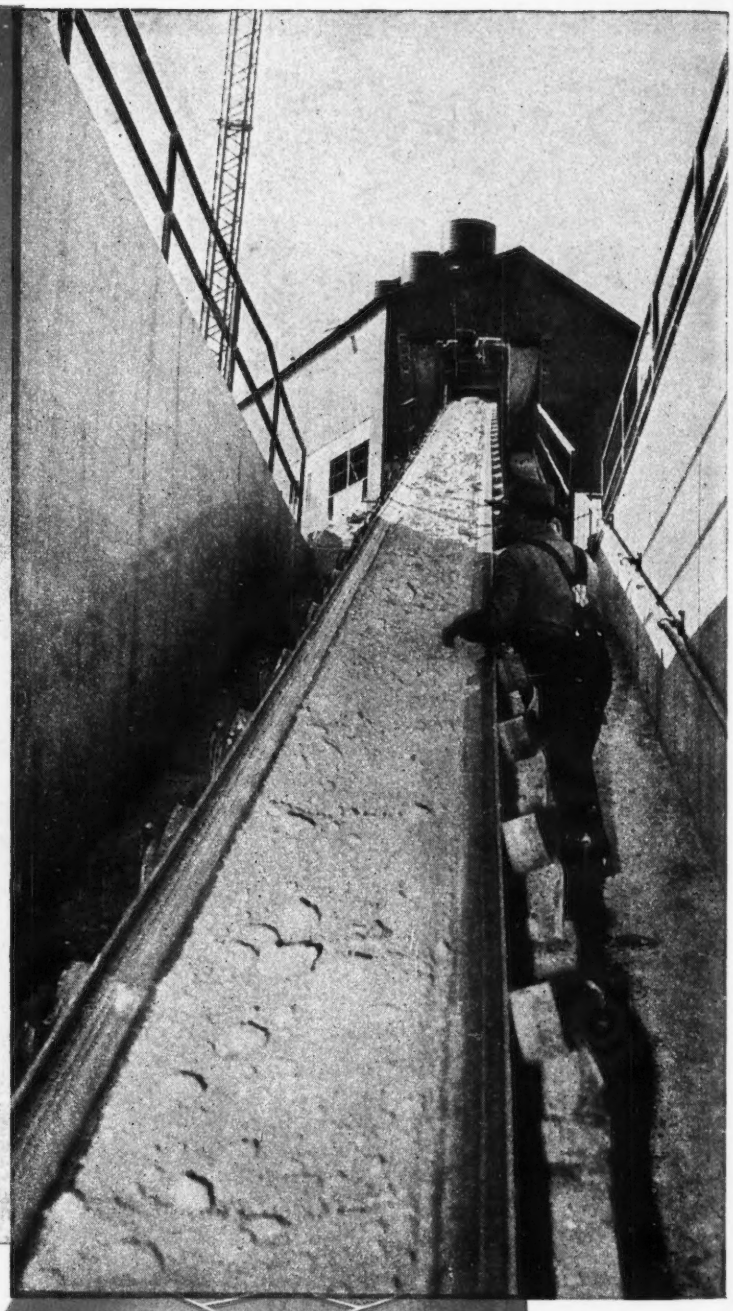
BOTH OF THEM PROFITABLE

Users report Lightning belt life up to three times that of smooth belt in the movement of fine material up steep inclines.

The unusual center rib-construction of Lightning Conveyor Belt grips material . . . wet or dry . . . in pocket-like divisions to prevent load slippage.

Elimination of load slippage reduces belt cover wear to the minimum. Belts can run slower to deliver rated tonnage.

When the ribs do finally wear down after long usage, Lightning Conveyor Belt may serve a long second life on flat conveying. Two belts for the price of one, then, is not uncommon to users of Lightning.



Get a grip on loose loads with LIGHTNING

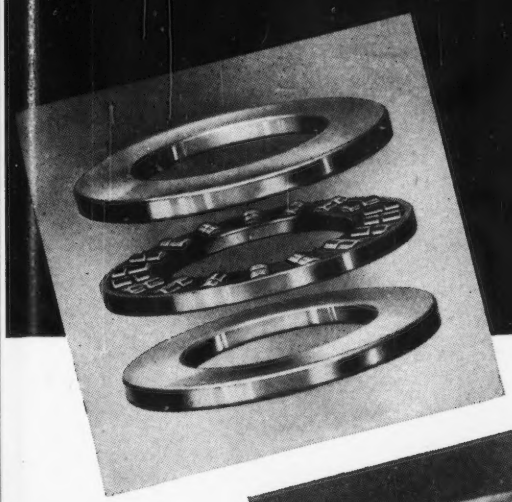
RIBBED CONVEYOR BELTS

The AMERICAN RUBBER Mfg. Co.
OAKLAND, CALIFORNIA
MANUFACTURERS OF RUBBER PRODUCTS FOR INDUSTRY

THE AMERICAN RUBBER MFG CO. • OAKLAND CALIF •

RIGHT ANGLE LOADING

Plus staggered rollers that will not "TRACK"...



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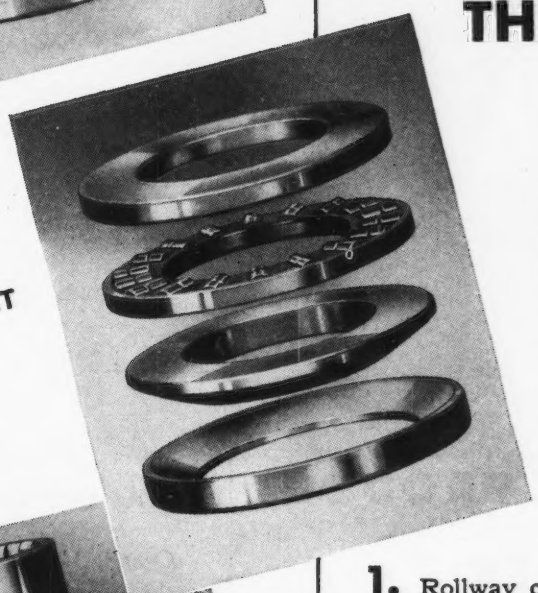

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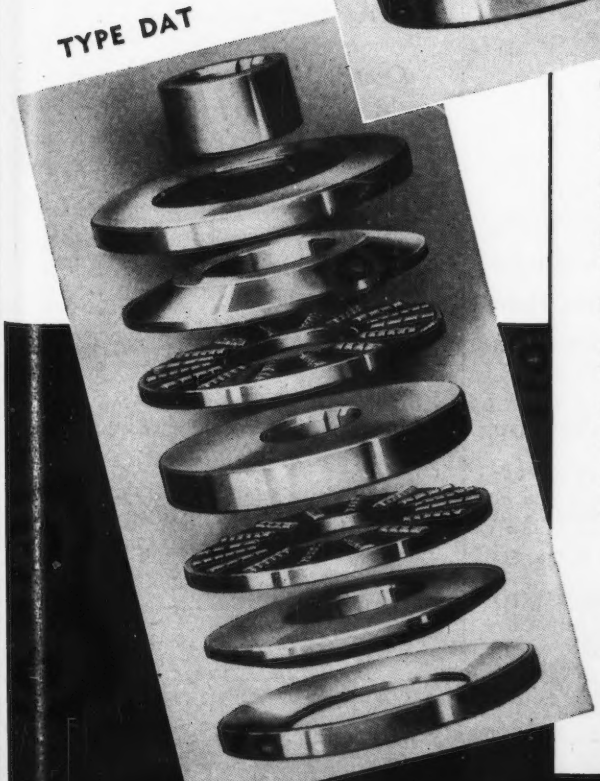

ROLLWAY

Solid-cylindrical-roller

THRUST BEARINGS

When thrust loads are heavy . . . when maximum bearing capacity in minimum space is required . . . when the aim is to design "preventive maintenance" into the mechanism itself . . . Rollway solid cylindrical roller Thrust Bearings offer sound solutions to the basic problems. Here are the reasons why:

1. Rollway carries all loads at right angles to the roller axes.

2. Rollway solid-cylindrical rollers—staggered in position and varied in length, so as to cancel out "tracking"—are accurately spaced in machined-bronze retainers.

3. Thrust plates, held to extremely close limits of parallelism, afford a linear contact with the straight cylindrical rollers, doing away with Brinell effect and roller "pinch outs" with its consequent roller-end wear and rubbing friction.

Six basic types in many sizes to choose from. Send a print or detailed description for free bearing recommendation.

ROLLWAY BEARING CO., INC.
SYRACUSE 4, N. Y.

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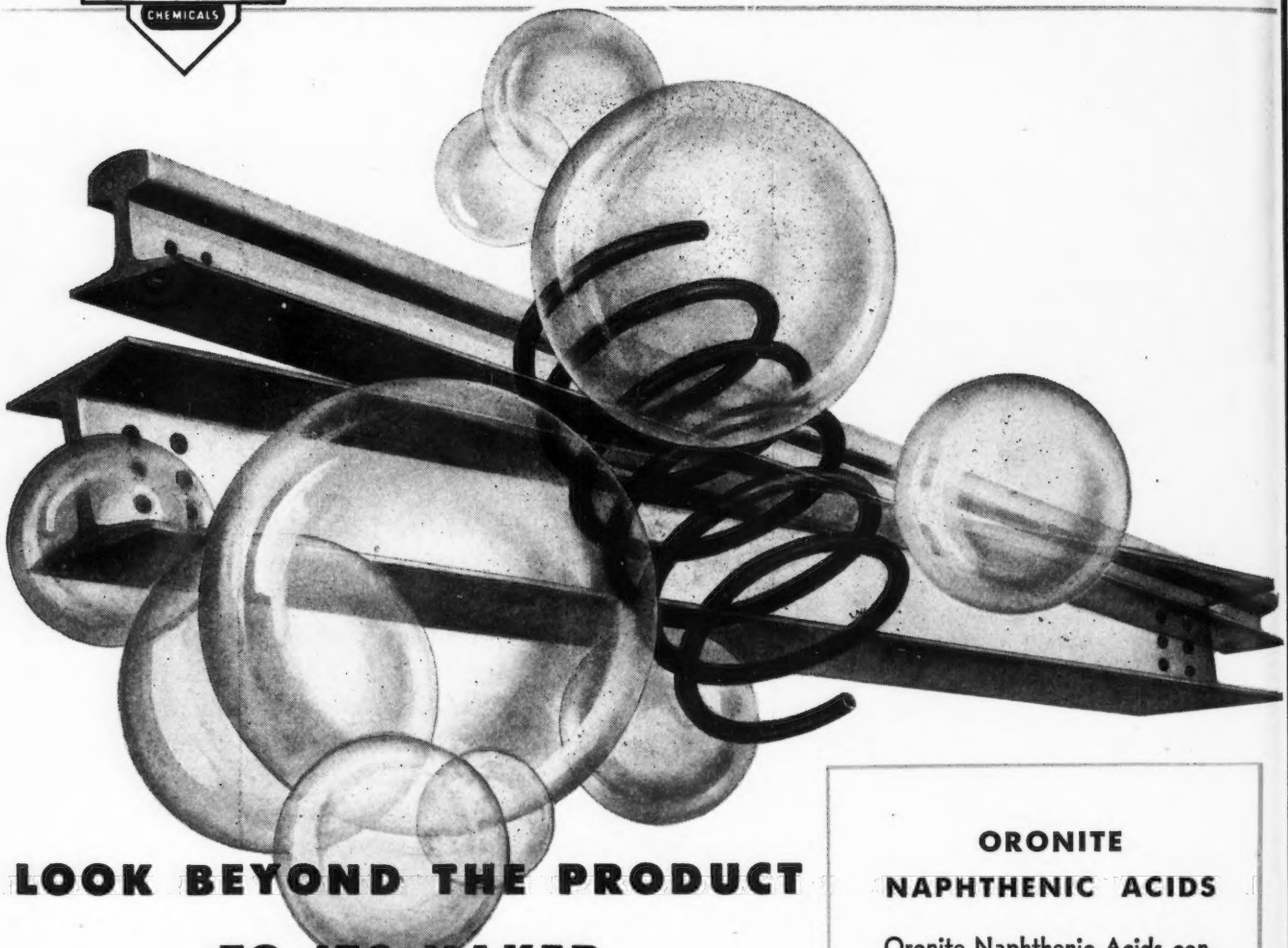
ORONITE CHEMICALS

THE NAME TO WATCH IN CHEMICALS



LOOK BEYOND THE PRODUCT TO ITS MAKER

The delicate strength of a chemical bubble is the priceless quality that makes possible the efficient recovery of metals by the flotation process. These "bubbles" can be no better than the chemical employed nor can the chemical be better than the chemist who creates and produces it.

"Oronite"* is the name to watch in chemicals. Whether you need a wetting agent or sulfonate . . . whether you are recovering metals by flotation and need a reagent . . . or making a special product that requires something new, you can look to Oronite with confidence and for the backing of an able group of research chemists whose resources are second to none.

Your inquiry will not obligate you in any way.

ORONITE NAPHTHENIC ACIDS

Oronite Naphthenic Acids consist chemically of a five membered carbon ring to which a carboxyl group (acid) and one or more alkyl side chains are attached. They combine with alkali to form soaps and as such, or alone, are used as flotation reagents. Those who are using Naphthenic Acids and who contemplate their use will do well to consider Oronite as a supply source. Complete data is available now, as are the services of the Research Division of this company. A letter indicating your interest will receive prompt attention.

*REG. U. S. PAT. OFF. 1004

ORONITE CHEMICAL COMPANY

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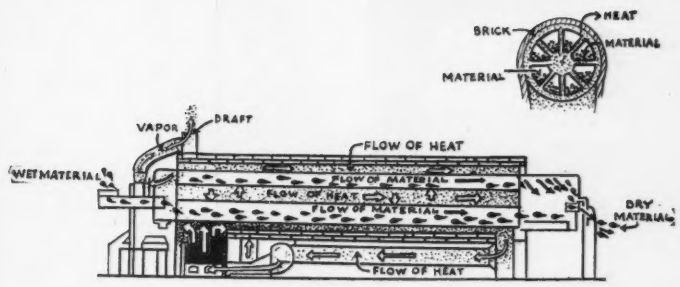
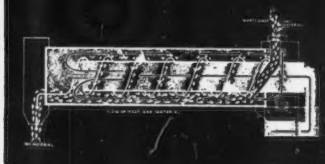
CHRISTIE

Rotary Dryers
Rotary Retorts
Coolers

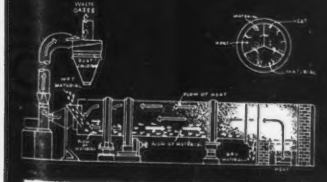


Dustless Dryer for Flotation Concentrates



Semi-Direct Heat Type

Direct Heat Parallel Flow Principle



Direct Counter Flow Principle

If
you have a
Drying or Calcining Problem

in which

A Rotary Dryer (or Retort)

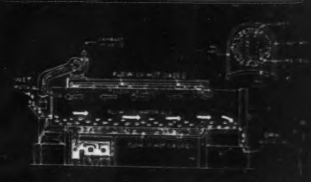
can be used

profit by our half century of specialized experience and cut operating costs. Details are constantly being improved with this idea in mind.

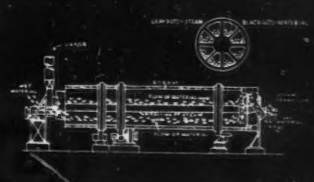
Write us regarding your problem and we will gladly work with you to a satisfactory conclusion.

A type and size for practically every kind of material and condition.

Steam Tube Principle



Enclosed Direct Heat Principle



Steam Jacketed Principle

17 E. 42nd Street
NewYork 17, N.Y.

The L.R. CHRISTIE CO.

Worn or Broken Surfaces can be BUILT UP *quickly* with "997" Low-Fuming Rod

Let's help the other fellow, too.

Under the stress of present industrial output, mechanical production equipment often feels the strain. Bronze Welding is being used extensively, not only for the repair of iron, steel and copper alloy parts, but also for the building-up of worn surfaces. If you've done an interesting bronze welding job that you feel would help the other fellow, tell us about it. If of general interest, we'll pass the word along in these pages.

With five teeth gone from this large gear and an important production unit stopped dead in its tracks, what's a Production Manager to do? A new gear meant patterns, castings, days of machining—weeks of delay. Pegging the broken teeth would cut down the delay—but increase the hazard of a repeated failure.

It's in a pinch like this that the importance of Bronze Repair Welding with the oxy-acetylene torch is most appreciated—for by using this fast, economical method of repair the gear was welded, machined and back in operation in a few days. Low temperature bronze welding with "997" Low-Fuming, Tobin Bronze* and other Anaconda Welding Rods is so controllable that it is often possible to weld parts without dismantling, and in many instances, finish by filing to a template.

"Don't Scrap It...Bronze Weld It!" is more than a slogan—it's a NECESSITY in many plants. Publication B-13 contains suggested welding procedures and examples of savings in repair time and expense. Write for a copy.

*Reg. U. S. Pat. Off.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut • Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

4490

ANACONDA from mine to consumer

Anaconda Bronze Welding Rods

Manhattan Conveyor Belts at: Top Left, one of the long inclined conveyors; and Top Right, Ore Bedding and Reclaiming Plant, La Oroya Smelter.

Manhattan Air Hose used in Carlos Francisco Mine, Casapalca.

Manhattan Rubber Products, through the long life and enduring service of FLEXLASTICS and Manhattan Strength Members, will help you keep mining costs down.

MANHATTAN EQUIPMENT AT CERRO DE PASCO

Cerro de Pasco, one of the world's most famous mining enterprises, is noted for the monumental engineering achievements which have secured low-cost mining and ore reduction despite the challenge of remoteness, high altitudes (12,000 to 16,000 feet) and the variety of ores and metals.

This corporation operates three large groups of mines at Cerro de Pasco, Morococha and Casapalca, a coal mine, concentrators, smelters, refineries, steam and hydro-electric power plants and a Cottrell fume-precipitation plant. It produces copper, gold, silver, lead, antimony, zinc and arsenic—all in important quantities.

To the production of these metals, Manhattan Rubber Products contribute an important part in low-cost mining, smelting and refining. Nearly 100 Manhattan Conveyor Belts, miles of Air Hose, and other rubber products are giving long, satisfactory service under severe and exceptional conditions.

During Cerro de Pasco's 42 years of continuous operation and expansion, more and more Manhattan products have been used to help reduce costs and speed production.

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES AND FACTORIES PASSAIC, NEW JERSEY

ARMY E NAVY

The term FLEXLASTICS is an exclusive Manhattan trade mark. Only Manhattan can make FLEXLASTICS.

RM

THEY'RE HERE!

NEW LPC CARRIMORS*

...IN 8 AND 14 YARD SIZES!

ONLY Scrapers in the World with ALL These Profit-Making Features

Easier Loading
Because of generous initial apron opening without movement of rear gate. Curved bowl design plus smooth interior and special offset cutting edges produce continuous "fountain action" in loading, while exclusive eccentric hoist sheaves permit effective "pumping" in loose material.

Easier Hauling
Thanks to lower draft, shorter wheel base and elimination of excess weight. Newly designed apron retains load under all conditions.

Faster, Cleaner Dumping
Because of positive forced ejection. Rear gate actually bulldozes the material out, scraping bottom and sides of bowl perfectly clean. High lifting apron moves ahead with rear gate, assuring speedy unloading of all materials, without sticking or jamming.

More Accurate Spreading
Assured by improved positive control.

Greater Stability
Thanks to low center of gravity and freedom from bulky overhead structures.

Greater Utility
Because wide, open-top bowl also permits overhead loading with shovel drag-line or bin.

COMPLETELY NEW FROM THE GROUND UP AND THOROUGHLY PROVED BY 2 YEARS OF TESTING

Everyone who has seen these new LaPlant-Choate scrapers in action has been quick to admit that "they have all the good points of other rigs—*and a lot more besides.*" Moreover, on scores of tough earthmoving jobs from coast to coast, these greatly improved cable outfits are proving far superior to competitive equipment in all phases of operation. But don't take our word for it. Ask your nearest LaPlant-Choate "Caterpillar" distributor to take you to see the new LPC's working. Then you'll learn why so many agree on LPC for *lowest possible cost per yard*—wherever tractor-drawn scrapers are indicated. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; San Leandro, California.

*Reg. U.S. Pat. Off.

LAPLANT CHOATE
EARTHMOVING AND LAND CLEARING EQUIPMENT

HOW MANY *of your Valves are draining Profits?*

When a valve is worn beyond the point of economical repair, it becomes a drain on profits. It may fail at a critical period in processing, ruining large quantities of materials controlled. It may interrupt production when its sudden failure forces a shut-down for repair or replacement. It is certain to require an excessive expenditure of maintenance time, labor, and materials.

Many valves have reached retirement age rapidly under the strain of wartime operation and neglected maintenance. Now that a plentiful supply of valves is in sight, management with an eye to future profits will plan early replacement of worn-out valves.

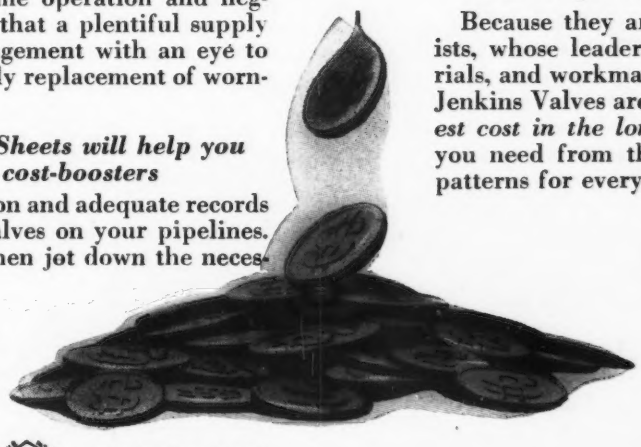
Jenkins Valve Record Sheets will help you cull out chronic cost-boosters

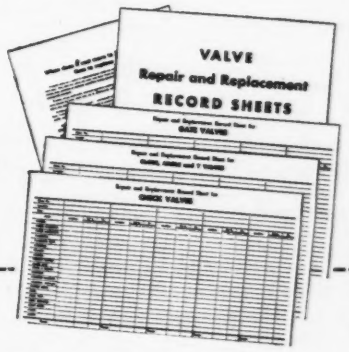
Only systematic inspection and adequate records will reveal the wornout valves on your pipelines. When your maintenance men jot down the necessary data on the simplified Jenkins Valve Record Sheets, you get a clear, complete picture of a valve's fitness for further use, – can tell at a glance whether repair will be economical, or replacement is advisable.

Your kit of Valve Record Sheets, including complete instructions, will be sent on request. Fill out and mail the coupon today.

Make replacements with Jenkins Valves

Because they are the product of valve specialists, whose leadership in design, choice of materials, and workmanship has long been recognized, Jenkins Valves are your best assurance of the *lowest cost in the long run.* Select the replacement you need from the Jenkins Catalog . . . over 600 patterns for every service.





Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal; London, England.

LOOK FOR THIS JENKINS DIAMOND MARK

Jenkins Bros

JENKINS VALVES

SINCE 1864

For every Industrial, Engineering, Marine, Plumbing-heating Service . . . In Bronze, Iron, Cast Steel and Corrosion-resisting Alloys . . . 125 to 600 lbs. pressure.

Sold Through Reliable Industrial Distributors Everywhere

JENKINS BROS.,
80 White Street,
New York 13, N. Y.

Send me a set of Jenkins "Valve Record Sheets"

Name .....

Company .....

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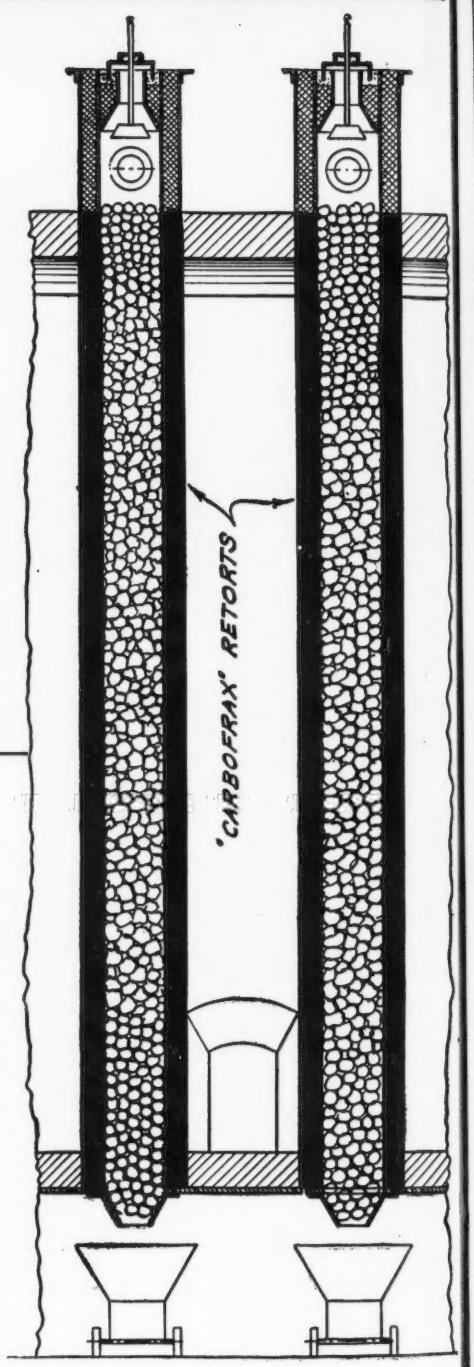
NO. 5 IN A SERIES DESCRIBING THE USE OF SUPER REFRACTORIES IN THE PROCESS INDUSTRIES

"CARBOFRAX" VERTICAL RETORTS

The ideal solution for many high-temperature indirect heating processes



ECONOMICAL OPERATION of the vertical retort for many high-temperature chemical and metallurgical processes has resulted from the use of "CARBOFRAX" silicon carbide retorts.

Much of this success is attributed to the high thermal conductivity of the "CARBOFRAX" retort. Having a conductivity eleven to twelve times that of fireclay, only moderate thermal gradients are required to transmit heat rapidly through the retort walls. Thus, combustion chamber temperatures are lowered—refractory difficulties are minimized—fuel efficiency is improved—closer temperature control is secured.

Long life and continuous service from the "CARBOFRAX" retort are assured by its high strength at elevated temperatures and exceptional resistance to mechanical abrasion and flame erosion.

There are many processes in the chemical and metallurgical fields to which super refractories by "CARBORUNDUM" can be advantageously applied to insure longer life—less maintenance—lower operating costs. Experienced refractories engineers will be glad to assist in their application. Write The Carborundum Company, Dept. E3, Refractories Division, Perth Amboy, N. J.

CARBORUNDUM
TRADE MARK

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Super Refractories by **CARBORUNDUM**
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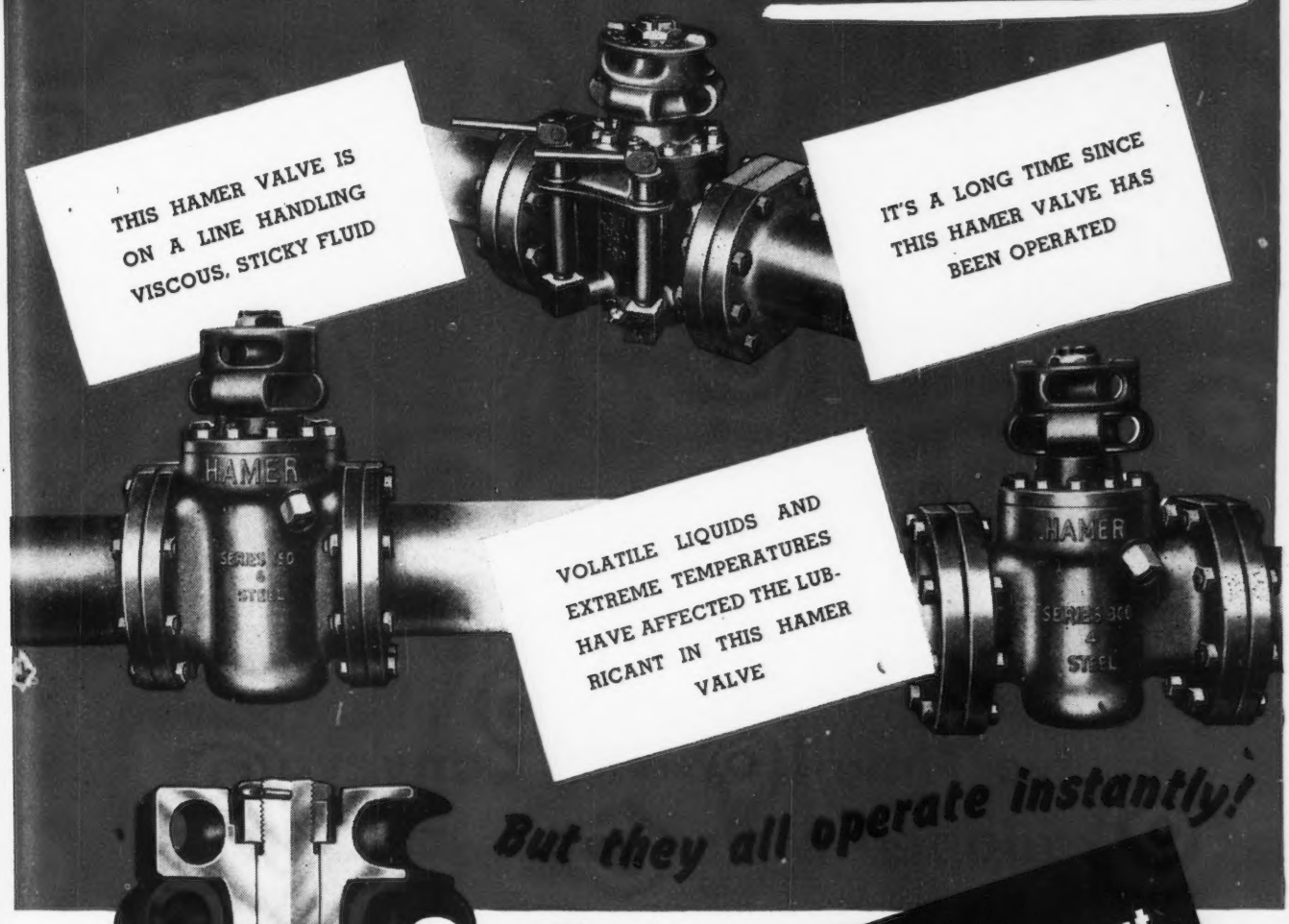
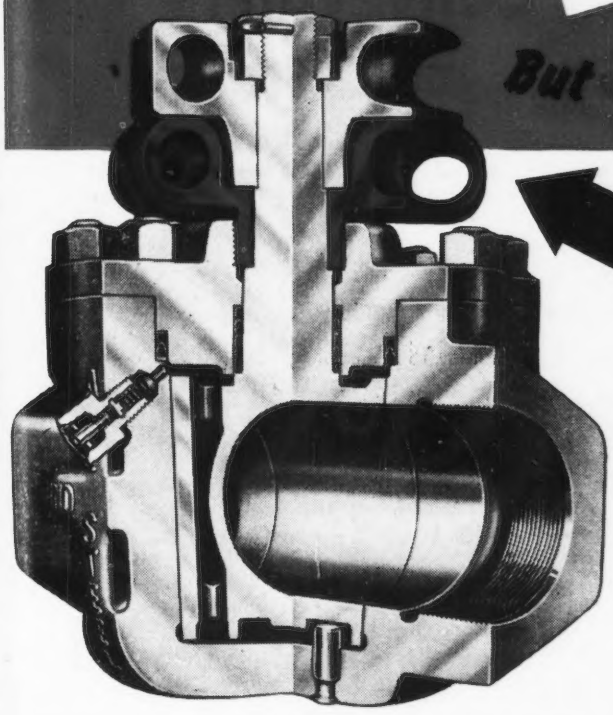
HAMER PLUG VALVES *NEVER STICK*


THIS HAMER VALVE IS ON A LINE HANDLING VISCOUS, STICKY FLUID
IT'S A LONG TIME SINCE THIS HAMER VALVE HAS BEEN OPERATED
VOLATILE LIQUIDS AND EXTREME TEMPERATURES HAVE AFFECTED THE LUBRICANT IN THIS HAMER VALVE
HAMER
HAMER

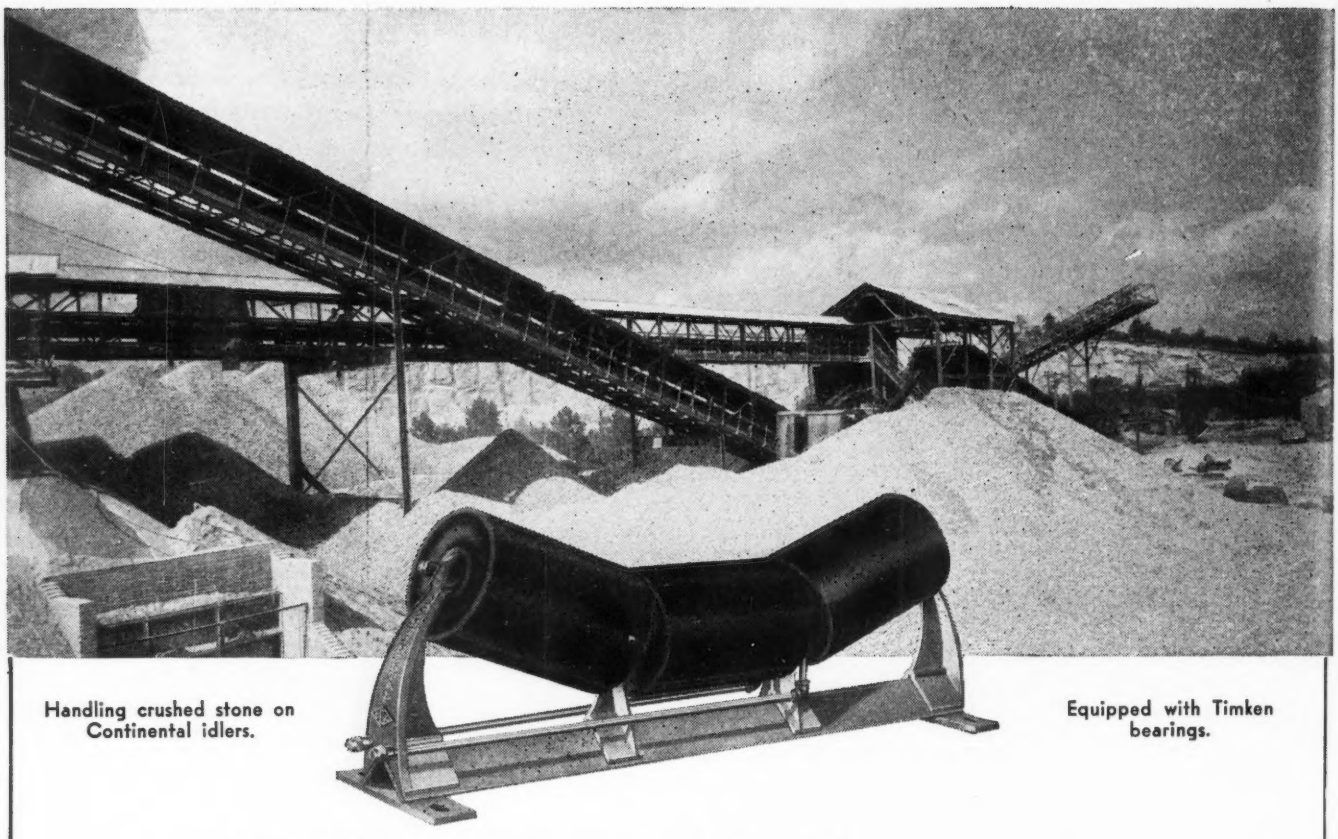
But they all operate instantly!



This plug adjusting nut gives positive control of the plug . . . at all times

Acting as a powerful screw-jack to lift the plug in the body and to return it to perfect adjustment, the exclusive plug-adjusting feature assures that Hamer Plug Valves will always operate, instantly and easily, under any conditions of service.

HAMER
OIL TOOL COMPANY
2919 GARDENIA AVENUE
LONG BEACH 7, CALIFORNIA



Handling crushed stone on Continental idlers.

Equipped with Timken bearings.

No Time Lost with Conveyors *Equipped with Continental Idlers*

Speed . . . manpower saving . . . economy. These are the three big reasons why so many time pressed industries which handle bulk materials are equipping their plants with Continental belt conveyors. Whether you need replacement idlers or a complete installation, Continental can fill your requirements. These idlers are made in a complete range of sizes with steel, cast iron or rubber covered rolls for every type of service.

Write for Engineering Data Book ID-105.

FOR THE WAR EFFORT
Six Army - Navy "E" Awards Since October 1941.

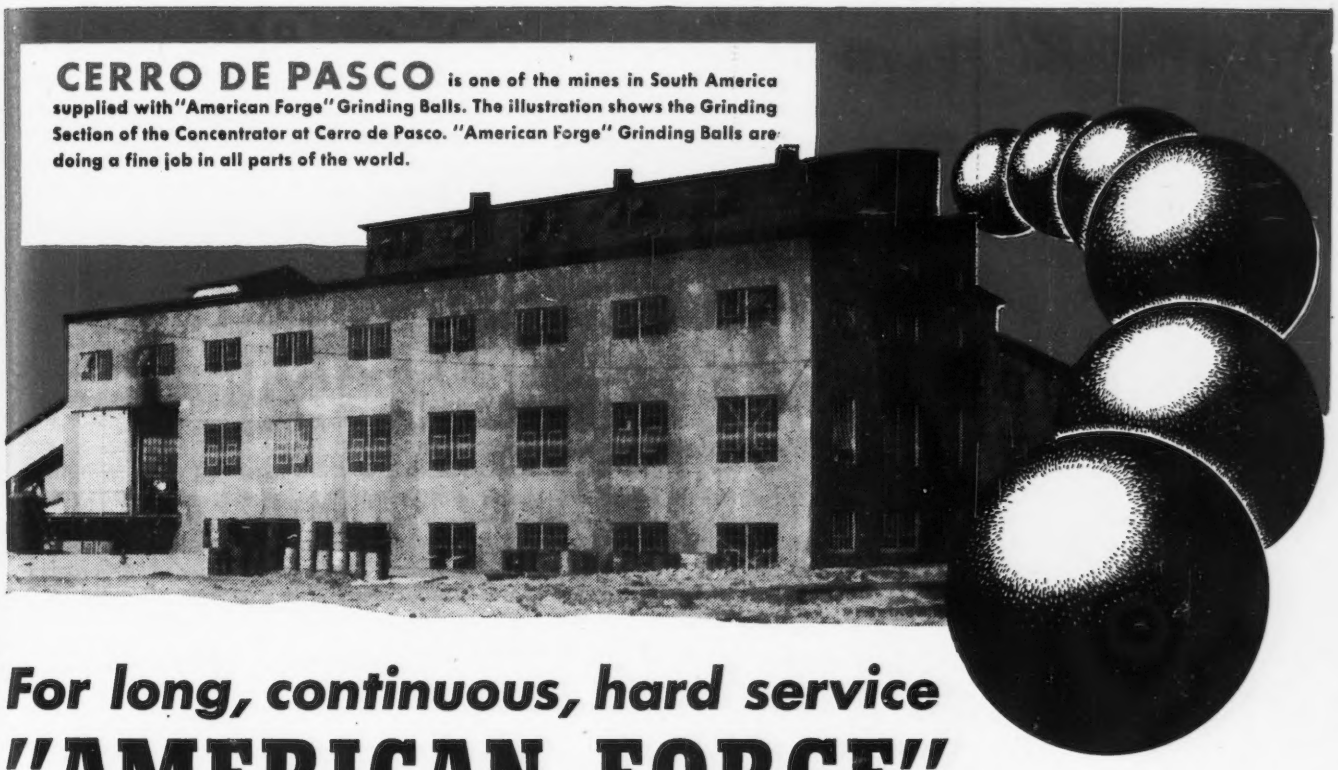
All types of accessories, such as pulleys, shafting, bearings, collars, flexible couplings, take-ups, hold-backs, speed reducers, trippers, belt cleaning brushes, V-belt and roller chain drives can also be furnished.

INDUSTRIAL DIVISION

CONTINENTAL GIN COMPANY

BIRMINGHAM, ALABAMA

ATLANTA • DALLAS • MEMPHIS



CERRO DE PASCO is one of the mines in South America supplied with "American Forge" Grinding Balls. The illustration shows the Grinding Section of the Concentrator at Cerro de Pasco. "American Forge" Grinding Balls are doing a fine job in all parts of the world.

For long, continuous, hard service

"AMERICAN FORGE"

Specializes in Rol-forged Steel, Heat Treated

GRINDING BALLS

In our big forging plant we operate a special Grinding Ball Department. We make a specialty of Grinding Balls for mines and cement plants. Our research department is continually improving the product—new types of grinding balls are being developed—we are continually working toward the production of the *super ball* which will cut grinding costs to a minimum. We use ELECTRIC FURNACE STEEL (either carbon or alloy) and by our Rol-forged process the grain structure and fibre formation are concentrated to give the utmost strength and toughness—heat treatment imparts greater hardness. Sizes ¾ inch to 6 inches. If you are in the market for *super service* Grinding Balls let us know your requirements and we will gladly quote prices.

Over 57 Years
OF
FORGING EXPERIENCE
together with modern and adequate equipment, are offered to the mining, oil, lumber, marine and industrial fields by the American Forge Company specializing in

GRINDING MEDIA
GRINDING BALLS
STAMP MILL SHOES & DIES
GRINDING SLUGS & MILL RODS

FORGINGS FOR
MILL ROLLS
DIESEL ENGINES
TURBINES
GEARS & PINIONS
MARINE & INDUSTRIAL SHAFTING
PIPE FLANGES

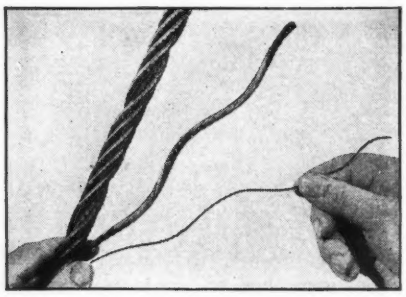
PRESS FORGED BARS & BILLETS

DROP FORGINGS

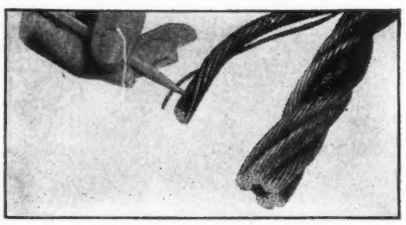
FORGINGS MADE TO CUSTOMERS' SPECIFICATIONS

AMERICAN
FORGE COMPANY
BERKELEY, CALIFORNIA

For maximum safety, service, economy



All wires and strands in Macwhyte PREformed are spiral shaped to fit naturally into position. When you select Macwhyte PREformed you get "the correct rope for your equipment," plus a personal interest in helping you get the most out of your rope.



All Macwhyte PREformed is internally lubricated! Macwhyte Wire Rope Lubricant is packed around each wire in all strands. This improves the sliding action of the wires as they move in bending around sheaves and drums. It also protects against inside corrosion.

You make sure of the best when you buy Macwhyte PREformed. It's a rope with less internal fatigue, less friction, better balance and longer life. It's a safer, easier-to-use rope. These extra advantages are acquired through PREforming — every strand is shaped to take its place *naturally* in the rope. Internal stresses are held to a minimum.

The wire that goes into Macwhyte PREformed is processed under constant metallurgical control in Macwhyte's own wire mill. And when this tough, flexible wire is assembled into strands, PREformed and internally lubricated under close supervision of Macwhyte wire rope craftsmen, it just has to be the correct rope for your equipment.

Macwhyte PREformed is especially recommended for your extra-tough jobs, though many wire rope users tell us it pays them to specify this superior rope for all operations. They say its greater life makes it cost less in the long run.

Get this Macwhyte Wire Rope Catalog!

170 pages of useful information. A request on your company letterhead will bring it to you promptly. Ask for Catalog G-15.

MACWHYTE COMPANY

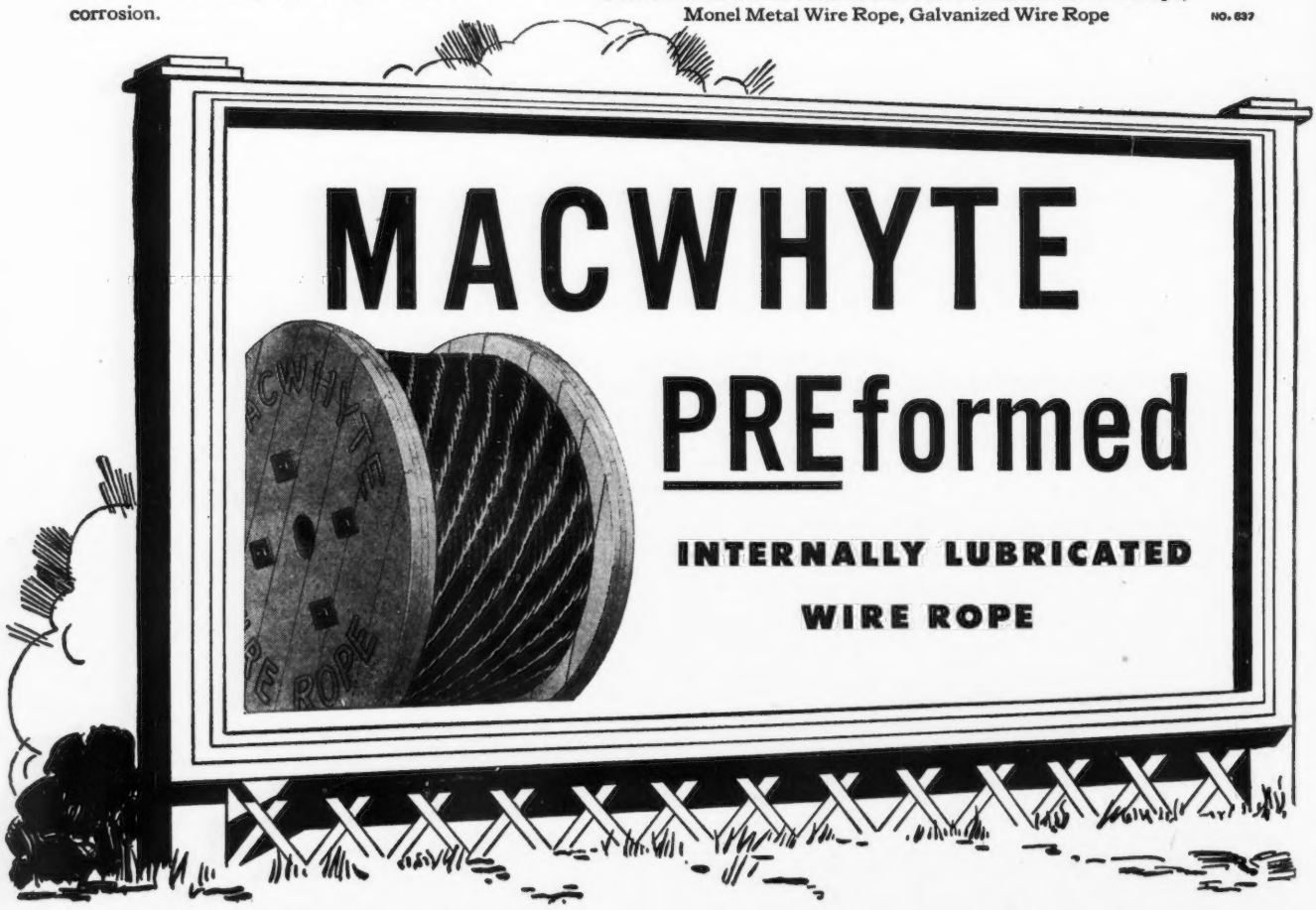
Wire Rope Manufacturers

2937 Fourteenth Avenue, Kenosha, Wisconsin

Mill Depots: New York • Pittsburgh • Chicago • Fort Worth • Portland • Seattle
San Francisco • Distributors throughout the U. S. A.

MACWHYTE PREformed and Internally Lubricated Wire Rope... MONARCH WHYTE STRAND Wire Rope ... MACWHYTE Special Traction Elevator Rope ... MACWHYTE Braided Wire Rope Slings ... MACWHYTE Aircraft Cables and Tie-Rods ... MACWHYTE Stainless Steel Wire Rope, Monel Metal Wire Rope, Galvanized Wire Rope

NO. 637



Heavy Media Separation

One of the newest and most rapidly growing methods of preparing coal and ores for market is the heavy media separation process.

Magnetite is one of the few materials economically suitable as a medium due to its low cost and ease of recovery by magnetic separation.

AVAILABLE IN LARGE TONNAGES OR EXPERIMENTAL QUANTITIES

Our sources of Magnetite supply are large and steady. Our plants are equipped to meet continuous demands for commercial tonnages or requests for small experimental quantities.

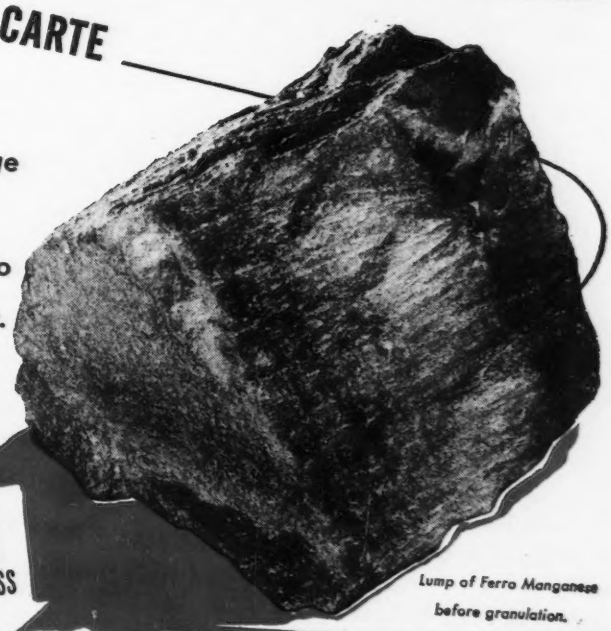
SIZED TO ORDER

Your work and worries are lighter when you use Foote Magnetite because, regardless of quantity, Foote Magnetite is available in sizes for your special needs from approximately 50 mesh down to 325 mesh and laboratory controlled for size, purity, and uniformity.

Let us help you investigate the advantages of Foote Magnetite and the size best suited for your purpose.

METALS & ALLOYS--A LA CARTE

Though you may first think of us as processors of ores and chemicals, a substantial percentage of our job is supplying alloys and metals of guaranteed analyses to industry . . . powdered to our standards or granulated a la carte to your specs.



Lump of Ferro Manganese before granulation.

Foote MINERAL COMPANY

A Step Ahead in Industrial Ores and Chemicals

NOTE NEW ADDRESS

PHILADELPHIA • ASBESTOS • EXTON, PENNSYLVANIA

Home Office: 512 GERMANTOWN TRUST CO. BLDG., PHILA. 44, PA.

West Coast Representative: Griffin Chemical Co., San Francisco, California

TRUCO REAMING SHELLS

for FAST and ACCURATE REAMING

Truco Reaming Shells are expertly made and held to exact tolerances. They ream accurately and clean and hold gauge so that low reaming costs are assured. In many cases, a Truco Shell, run behind a Truco Bit, prevents injurious vibration and contributes to longer bit life.

As in the case of Truco Bits, drillers prefer Truco Shells, particularly when drilling deep holes, because they are dependable. Truco Bits and Shells are made to fit each other, so that there is no step-up between the blank sizes. This insures long shell life by allowing the sludge to pass away freely and prevents it binding around the shell.

The wear-resisting and diamond-gripping properties of the Truco patented matrix metal in which the diamonds are set and the excellent quality of the diamonds themselves, insure utmost durability, economy and satisfaction from the use of Truco Reaming Shells.

WHEEL TRUEING TOOL COMPANY

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Detroit 6 • Michigan

575 Langlois Avenue
Windsor, Ont. • Canada

O.K. of a Great Critic...

A WHOLE PLANTFUL OF THEM WHO BUILD MOTORS TO SATISFY EXACTING BUYERS!

Other plants may turn out *more* motors than the Star Plant. But you'll find no *better* motors . . . for when you see the Star Trademark you see the "O.K." on the efforts of hundreds of meticulous craftsmen working to critical standards.

Among them are the men who own the company. For Star's owners are born motor men, and the place to find them is out in the plant or around a drawing board, helping to make Star Motors as good as they can be.

Everybody at Star is exacting about quality . . . in design, materials, workmanship. There's a craftsman's spirit everywhere that words can't cover. But motor buyers who visit us always comment on it. And exacting motor users recognize that Star does things a bit better by specifying Star where a motor must be better than "good enough".

WRITE FOR 8-PAGE DIGEST. It outlines Star Motors (⅛ to 200 HP) and Generators (to 150 KW) . . . names hard-to-satisfy buyers who are long-time customers . . . tells how Star becomes the "Motor Department" for customers. Star Electric Motor Co., 236 Bloomfield Ave., Bloomfield, New Jersey.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

Each Ton of Grinding Balls Grinds More Ore When Chromium Alloy Grinding Balls are Used

Chromium in small percentages (1 to 3 per cent) in iron or steel grinding balls for ball mills gives these balls greatly increased life. The moderate increase in the cost of the chromium addition is saved many times over in the increased tonnage of ore ground for each ton of grinding balls used.

Chromium hardens and toughens the iron deep into the core of the ball, which increases wear resistance and length of service.

The same wear resistance that gives low-chromium alloy grinding balls their long life is useful also in many other mining and milling operations. Low-chromium alloy irons are being successfully used in ball mill liners, pumps, cable hoist brake rings and drums, gears, cylinder liners, and stoker and furnace parts.

For information on how to make and use chromium alloy irons, write for the booklet, "Chromium in Cast Iron".

* * *

We do not make iron or steel, but we do produce EM Chromium Briquets, ELECTROMET Foundry Grade Ferrochrome, and other alloys for foundries and steel plants. Our metallurgists have a background of more than 39 years experience with alloy cast irons and steels, both in the laboratory and in the field. Call on us if you have a problem on the melting or use of alloy irons and steels.

BUY AND HOLD UNITED STATES VICTORY BONDS AND STAMPS

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
ELECTROMET Ferro-Alloys and Metals
are sold by Electro Metallurgical Sales Corporation, and
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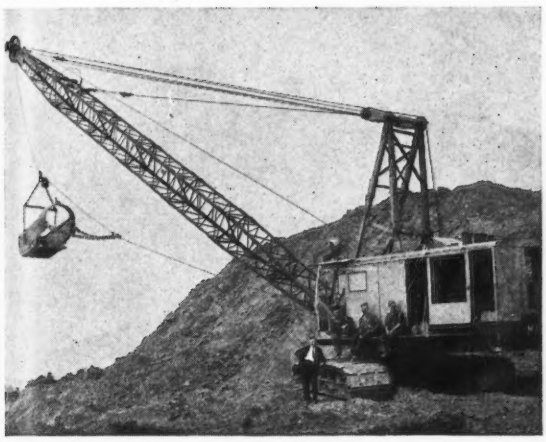
How to Move MORE CUBIC YARDS

. . . at lower cost

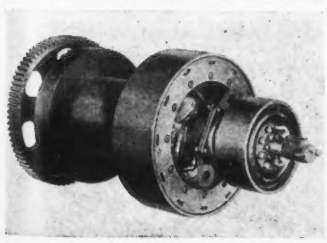
Experience has proved that shovels, cranes, dredges and draglines equipped with Fawick Airflex Clutches give you new *full-time* operating efficiency.

1. These clutches absorb torque, shock and vibration, and transmit power through a cushion of air.
2. They have no arms, springs or levers to break, wear out or get out of adjustment.
3. They require no lubrication—maintenance costs are unusually low.
4. Their flexible cushioning action protects *both* motor and mechanism.

The RESULT—more hours of effective service—fewer breakdowns—more material moved—at lower cost per cubic yard.

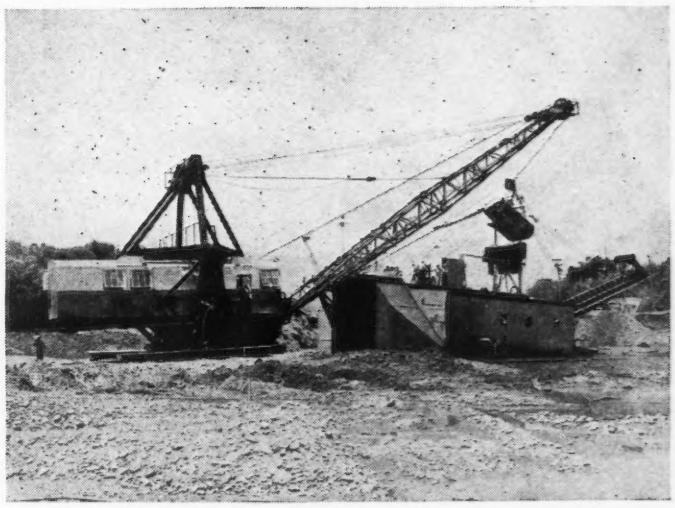


Fawick Clutches are providing new efficiency for shovels, cranes, draglines and hoists.



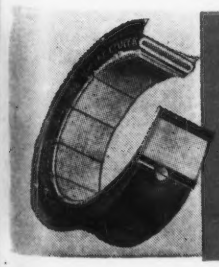
▲ Seven Fawick Clutches are used on the Byers ½ cu. yd. "Traveler."

◀ Hoist drum assembly of the shovel above — Fawick equipped.



Marion dragline, equipped with Fawick Swing Clutches.

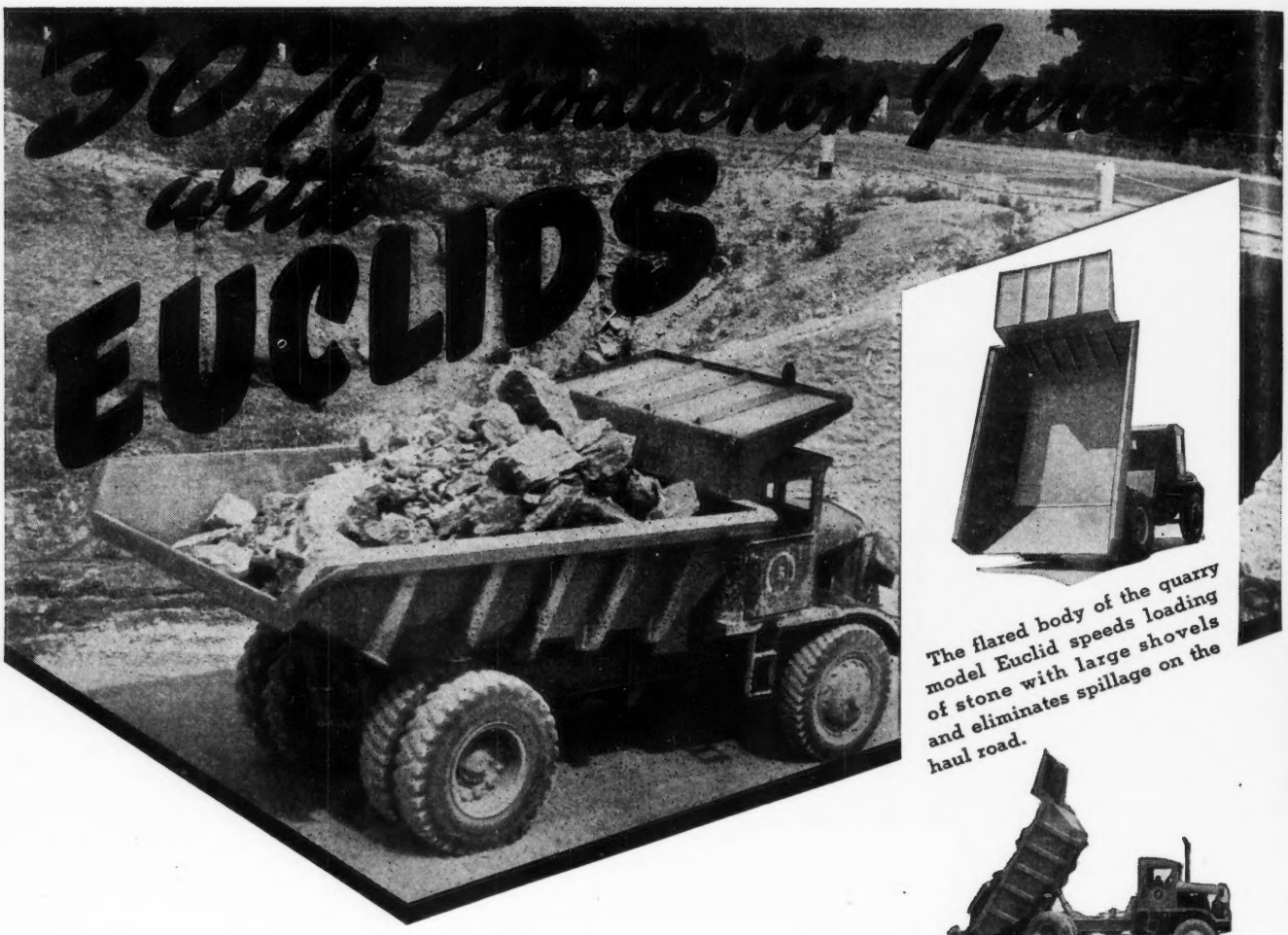
Write us for complete data, and recommendations engineered to suit your equipment. Book on request.



FAWICK *Airflex* CLUTCH

FAWICK AIRFLEX CO., INC. • 9919 Clinton Road, Cleveland 11, Ohio

In Canada, Reynold-Coventry Ltd., Montreal, Toronto, Vancouver • In Britain, Crofts Engineers, Ltd., Bradford, England



The flared body of the quarry model Euclid speeds loading of stone with large shovels and eliminates spillage on the haul road.

Tapered chute construction and high dumping angle mean quick, clean shedding of the load — save time in dumping.

● After more than 40 years of quarry operation by rail, The Bessemer Limestone and Cement Co. converted its haulage system to heavy duty trucks thereby achieving a production increase of approximately 30%. The job involves removal of overburden and delivery of blasted rock to a crushing plant. At this quarry in western Pennsylvania, Bessemer operates 5 Quarry Type Rear-Dump Euclids.

After receiving a 15-ton load from a 5 cu. yd. shovel, the Euclids travel 6500 feet to the crushing plant at an average speed of 12.3 m.p.h. Total round trip time averages 13 minutes — better than 4 trips per hour.

The flexibility of truck haulage over constantly changing roads has resulted in lower costs and increased production. For overburden removal, too, Euclids have proved their efficiency and dependability.

Have you investigated the possibilities of Euclids for your own operations? Your distributor can supply helpful information and literature.

The EUCLID ROAD MACHINERY Co.
CLEVELAND 17, OHIO

★

EUCLID EARTH MOVERS

Rear-Dump Euclids
Capacities of 15 to 22 tons — 9.2 to 20.7 cu. yds., struck... loaded top speeds of 22 to 36 m.p.h.... powered by 150 to 275 h.p. Diesel engines.

Bottom-Dump Euclids
Capacities of 20 to 32 tons — 13 to 42.9 cu. yds., struck... loaded speeds from 26 to 34.4 m.p.h.... powered by 150 to 275 h.p. Diesel engines.

Euclid Loader
Fast loading of hauling equipment ...makes shallow cuts to 9'6" wide...maximum cutting depth of 24"...54" belt powered by 150 h.p. engine.

EUCLID SELF-POWERED HAULING EQUIPMENT
For EARTH . ROCK . COAL . ORE

EUCLID THE PIONEER

At Your Finger Tips...

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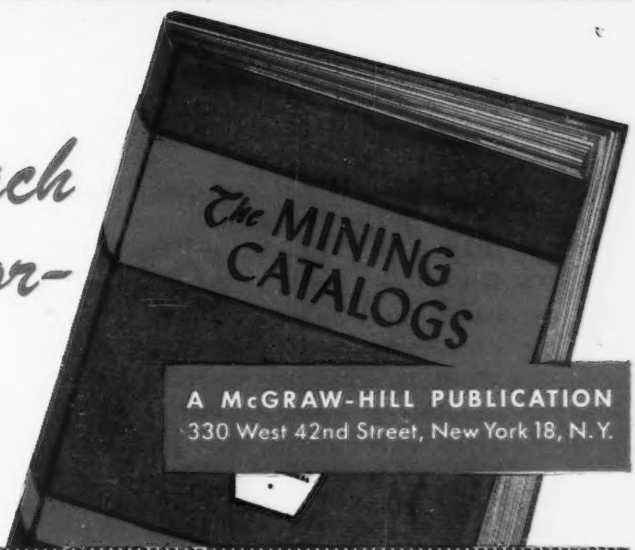
SPECIFICATIONS

On Mining Machinery, Equipment and Supplies

WHETHER it's a crusher, some bearings or a reel of wire rope that you're going to buy for your company, look it up in *The Mining Catalogs*. The information you get in *The Mining Catalogs* is up-to-date, concise but complete, and easy to locate quickly. Manufacturers have condensed their complete catalog information to speed up your search.

10,000 men responsible for specifying or requisitioning are using *The Mining Catalogs* regularly. It makes those jobs easier. Be sure you are on the list to receive your copy of the 1945-1946 edition . . . send the coupon today.

Reach for-



THE MINING CATALOGS, 330 West 42nd St., New York 18, N. Y.

Gentlemen: I am responsible for specifying and requisitioning equipment and supplies needed at our property and do not have access to THE MINING CATALOGS. Please reserve a copy of the 1945-1946 edition for me. (If my country imposes a duty on such Catalog books, I agree to pay same).

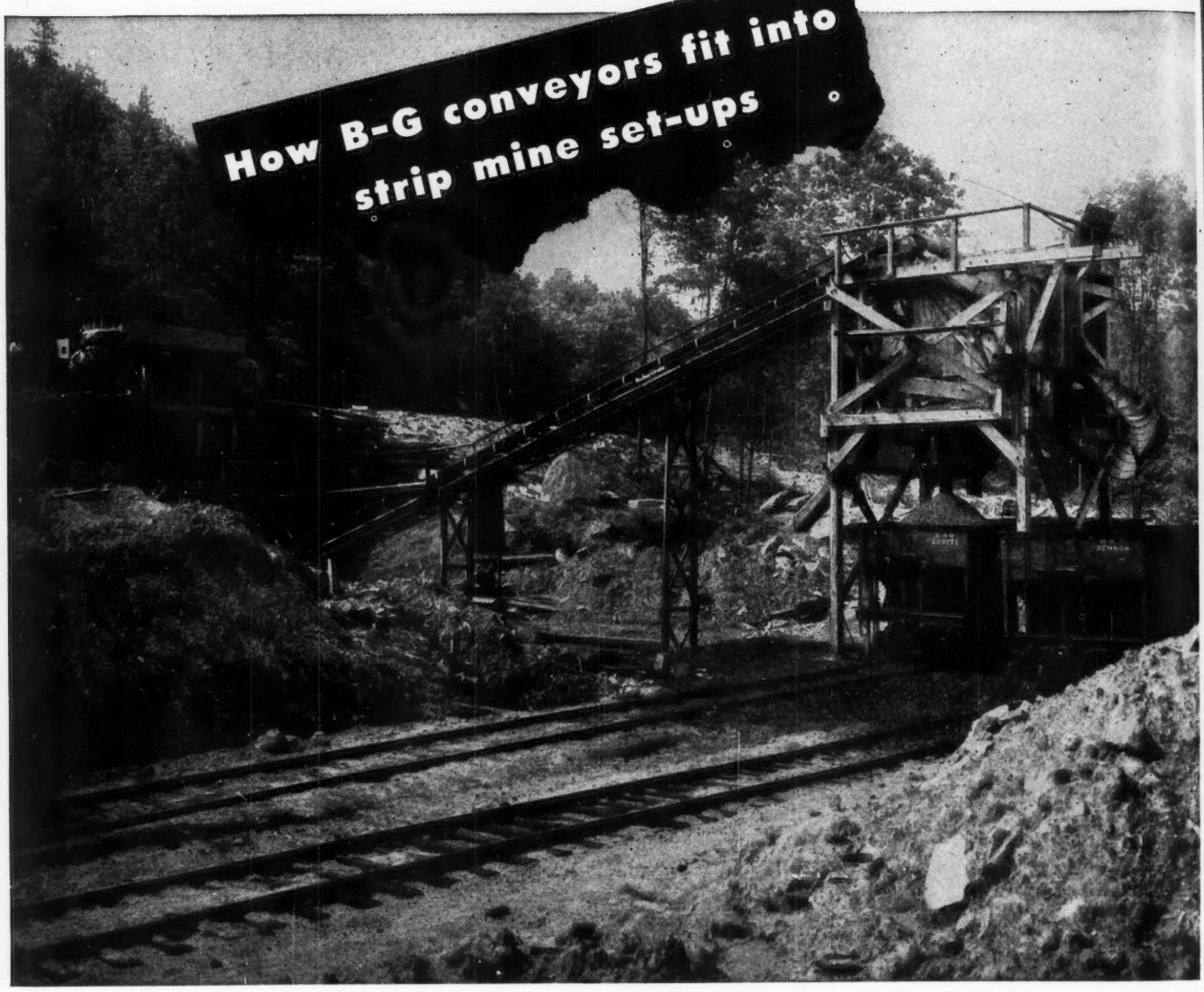
Name..... *Title*.....

Company Name.....

Company Address..... *State*.....

The nature of our operation is.....

How B-G conveyors fit into strip mine set-ups



Getting the material from dump truck to car bin can be the simplest and cheapest step in your whole series of strip mine operations—if you install a Barber-Greene Permanent Conveyor to do the job.

In a set-up like this, B-G Conveyors fit perfectly. They're built of *standardized* units in a variety of capacities and horsepower ratings. Factory assembly of terminals assures correct alignment . . . minimum belt wear and maintenance. *Pre-engineering* eliminates special engineering at the location. And your own workmen can erect this B-G Conveyor quickly and easily by merely bolting the conveniently marked sections together.

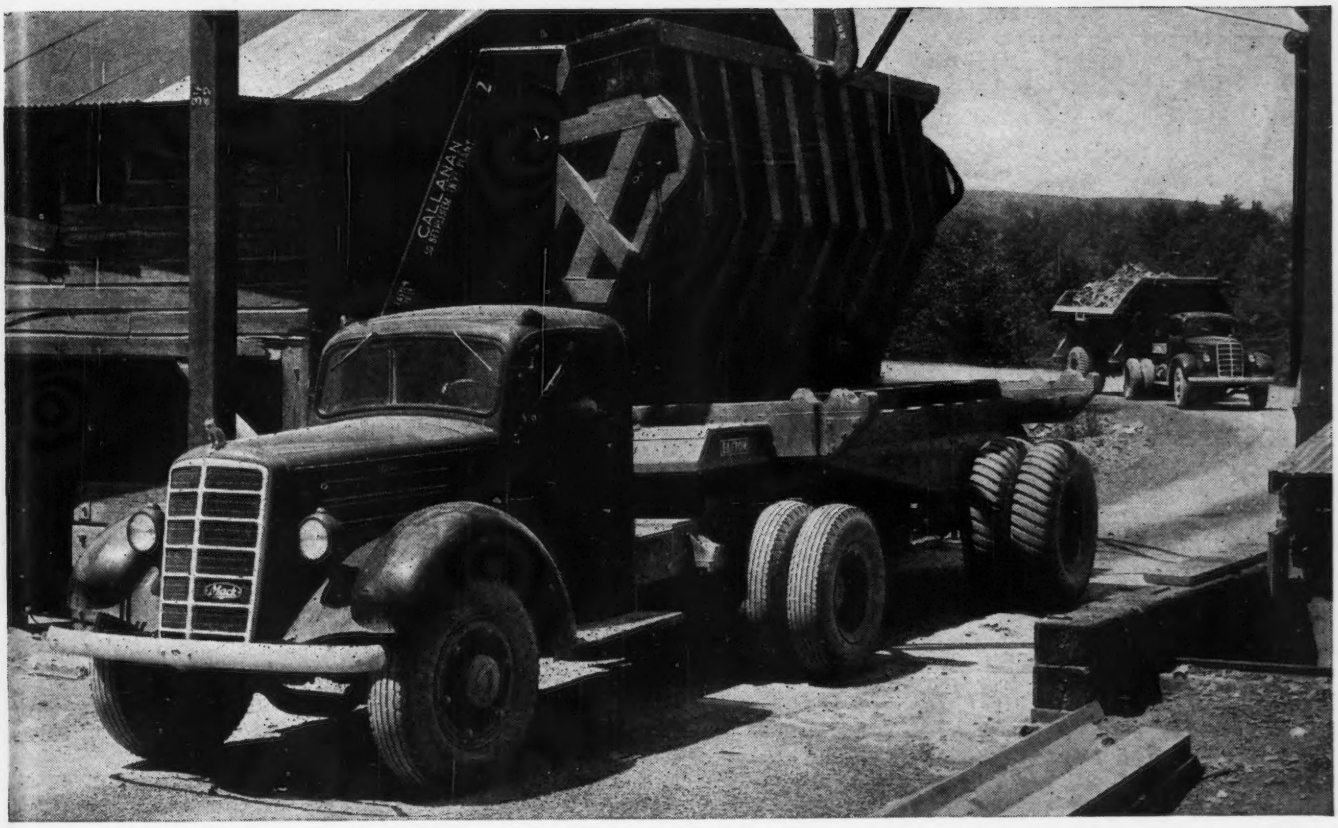
You'll get *extra* years of service from B-G equipment, for rugged construction is a Barber-Greene characteristic. Barber-Greene Company, Aurora, Illinois.

Photo shows B-G Permanent Conveyor loading run-of-mine material, and consisting of Pre-engineered, Factory-assembled Drive End, Standard B-G Truss and Walkway, Troughing Carriers, 36-inch Belt. Dump truck discharges into Hopper over conveyor tail end onto B-G Bar-flight Feeder.

45-62A

Barber-Greene B G *Constant Flow Equipment*

Macks Beat Locomotives



IN THIS MODERN QUARRY OPERATION!

THE JOB: *Hauling rock in the South Bethlehem quarry of the Callanan Road Improvement Company.*

THE OLD WAY: *Steam locomotives and tipple cars.*

THE NEW WAY: *Mack EHT's and Easton semi-trailers with tipple bodies.*

THE ADVANTAGES: *(From a letter from Keith M. Callanan, President)*

No more track moving cost. With locomotives, track had to be moved after every cut so that material from the next cut could be loaded.

No more track cost and delay when making primary well drill shots. Formerly track had to be moved from face of quarry before making well drill shot, then replaced, before operations could begin. Result: delays up to 2 days, high labor costs. With Macks, an old shot is finished, the new blast laid and hauling begins within a few minutes.

Flexibility in digging. With railroad system, shovel was always hemmed in on one side by the track; was therefore held up when bottom was hit or bad digging encountered. With trucks, shovel is moved to another pit and production continues without interruption.

Easier maintenance. Steam had to be kept up in locomotives all through the night and over week ends. In cold weather, pipes and water lines sometimes froze. Trucks eliminate all this bother and expense, are always ready for work in the morning.

THE IMPORTANCE FOR YOU:

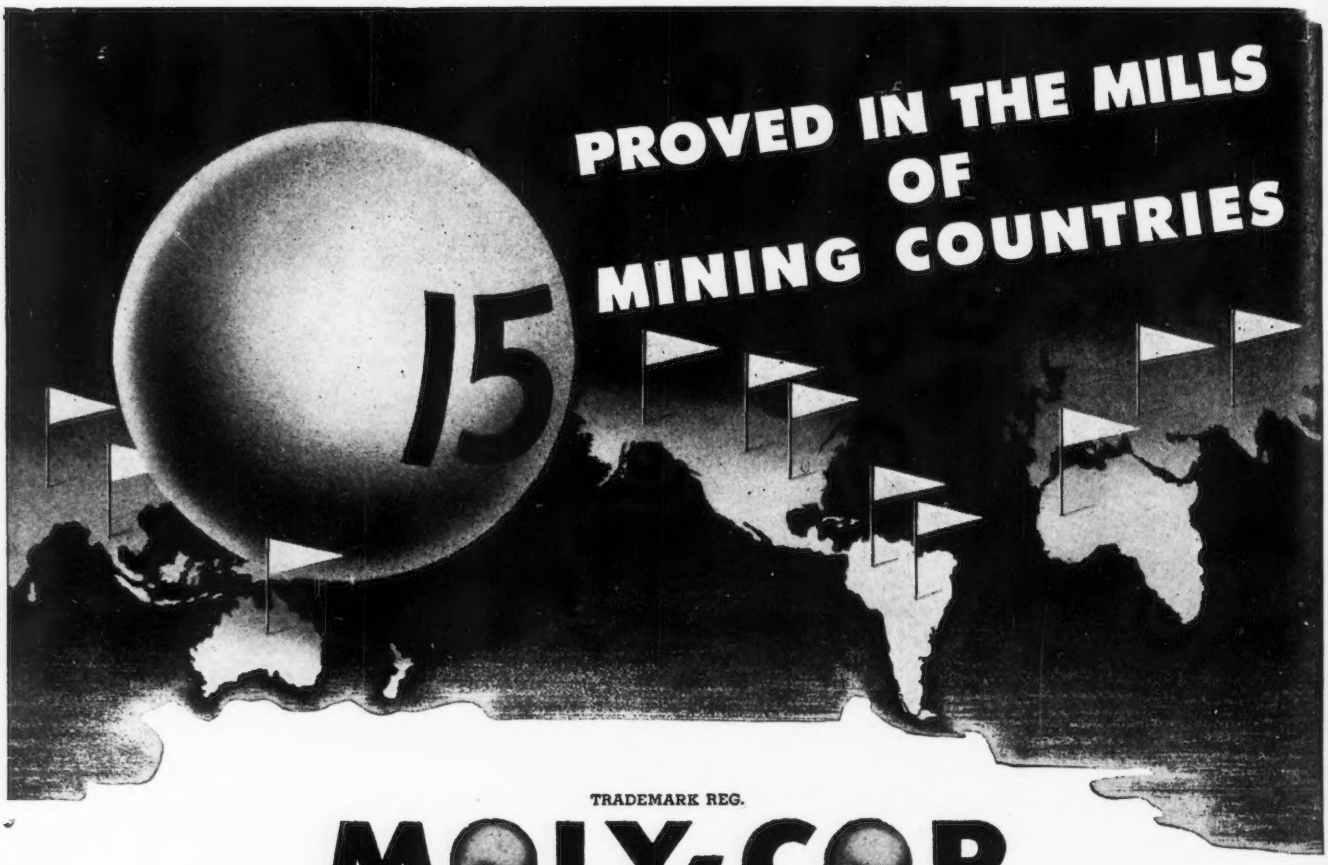
There may be a job in your mining or quarrying operations where the use of Mack Trucks would save time, money and trouble. Why not discuss it with your local Mack dealer? He's qualified and eager to help.

★ **BUY THAT VICTORY BOND TODAY** ★

Mack Trucks, Inc., Empire State Building, New York 1, N. Y. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts.

Mack
TRUCKS
FOR EVERY PURPOSE
ONE TON TO FORTY-FIVE TONS

Performance Counts



TRADEMARK REG.

MOLY-COP

COPPER-MOLYBDENUM-ALLOY

GRINDING BALLS

Increase Grinding Efficiency—Lower Grinding Costs

Mills throughout the United States and 14 other mining countries have found the easiest way to lower grinding costs, make profitable the milling of lower grade ores and obtain a finer grind with the use of Sheffield MOLY-COP Grinding Balls. Developed from a special alloy steel, forged and heat-treated, Moly-Cop Balls are tough and hard right to the core. That's why Moly-Cop Balls won't spall or flake. They retain their shape, give far more tons of ore per pound of balls. Handling, freight, mill liner and other milling costs are decreased, production increased, with Moly-Cop Balls.

SHEFFIELD STEEL

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SHEFFIELD STEEL OF TEXAS
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Massive forgings demand utmost ability — in conception and in execution. At Midvale, work like this — from start to finish — draws upon the high skills, wide knowledge and long experience of individuals, working as a team. Specialists in perfection, equipped with proper tools and machines — they produce in steels, from even the most intricate designs, whatever's needed for industry.

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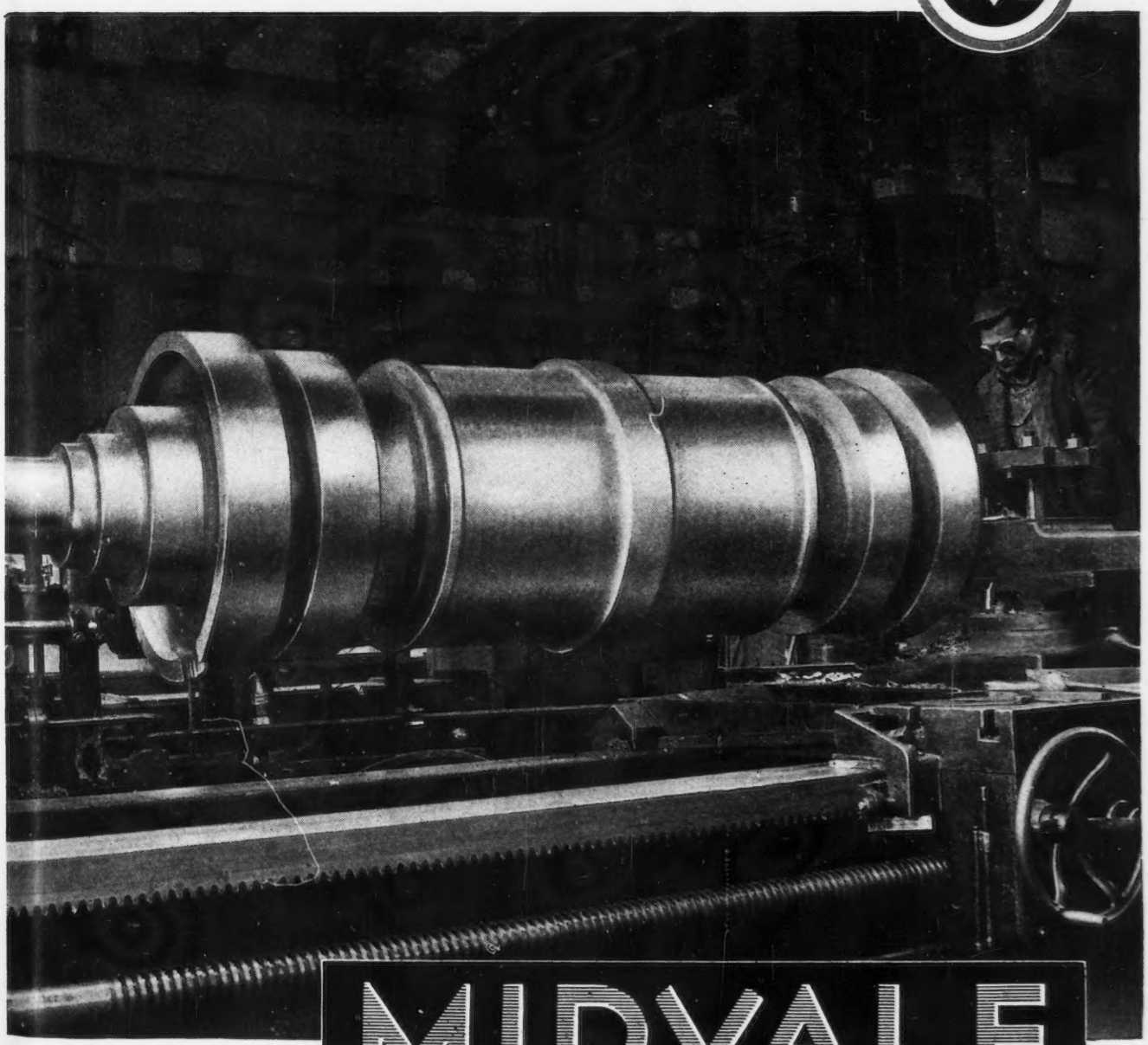
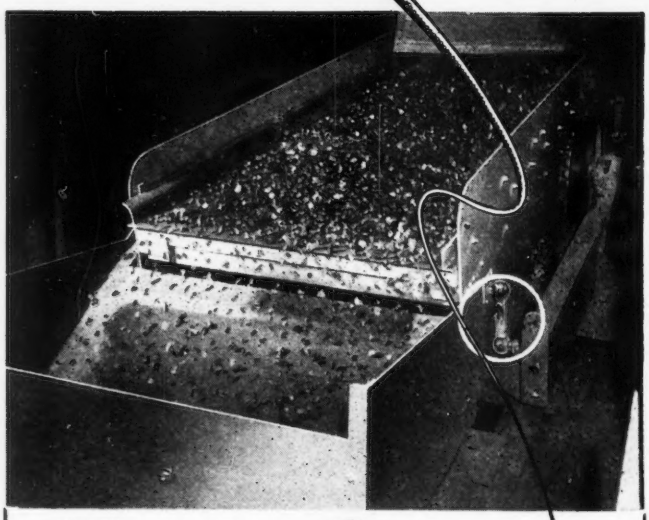


MIDVALE

Custom Steel Makers to Industry

SECO'S Sharper Whip



Pays Off

by Screening More Tons Per Hour

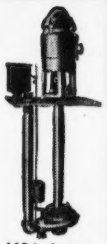
Operators everywhere are reporting increased tonnages screened with Seco Vibrating Screens. That's because Seco's patented method of connecting the live body to the base frame enables a fully controlled, circular motion that is evenly distributed over the entire screen surface. Thus, materials are driven more quickly and more thoroughly through the meshes no matter how the load is distributed. Over 200 models to choose from. Send Seco screening experts your screening problem today. Write Dept. C.

SECO SCREEN EQUIPMENT CO., INC.
9 Lafayette Avenue, Buffalo 13, N. Y.

They Will PROVE to You How GOOD They Are

PUMPS "by Aurora"

No matter how exacting your requirements, there is a size and type of Aurora Centrifugal or Apco Turbine-Type Pump to handle it PERFECTLY. Products of experience. Built by exclusive makers of fine pumps.



NSA Aurora Centrifugal Sump Pump

Aurora Deep Well Turbines for all conditions—4" to 24"

Type AD Hor. Split Case, Two Stage Centrifugal

Type OD Hor. Split Case Double Suction Single Stage Centrifugal

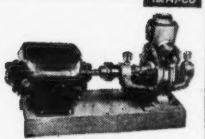
Type G M C Close-Coupled Centrifugal

Apco Turbine-Type Pumps The simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.

The ONLY MOVING PART IN The APCO

Type GGU Side Suction Single Stage Centrifugal

APCO Horizontal Condensation Return Unit



APCO Single Stage Turbine-Type

Write for **CONDENSED CATALOG M** *or See Our Catalog in* **SWEETS.**

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Perforated Plate

Round, square, hexagonal—any shape or size of perforation in any commercially rolled metal. Exactly to your specifications. Hendrick Manufacturing Co., 70 Dundaff Street, Carbondale, Pa., or consult Telephone Directory.

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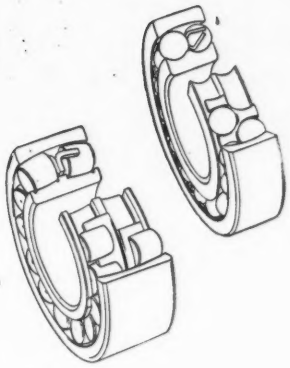

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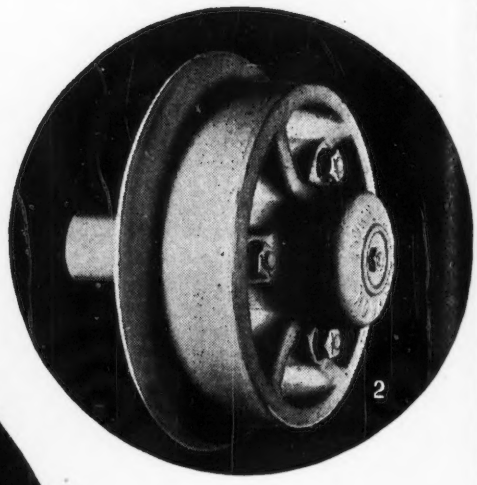

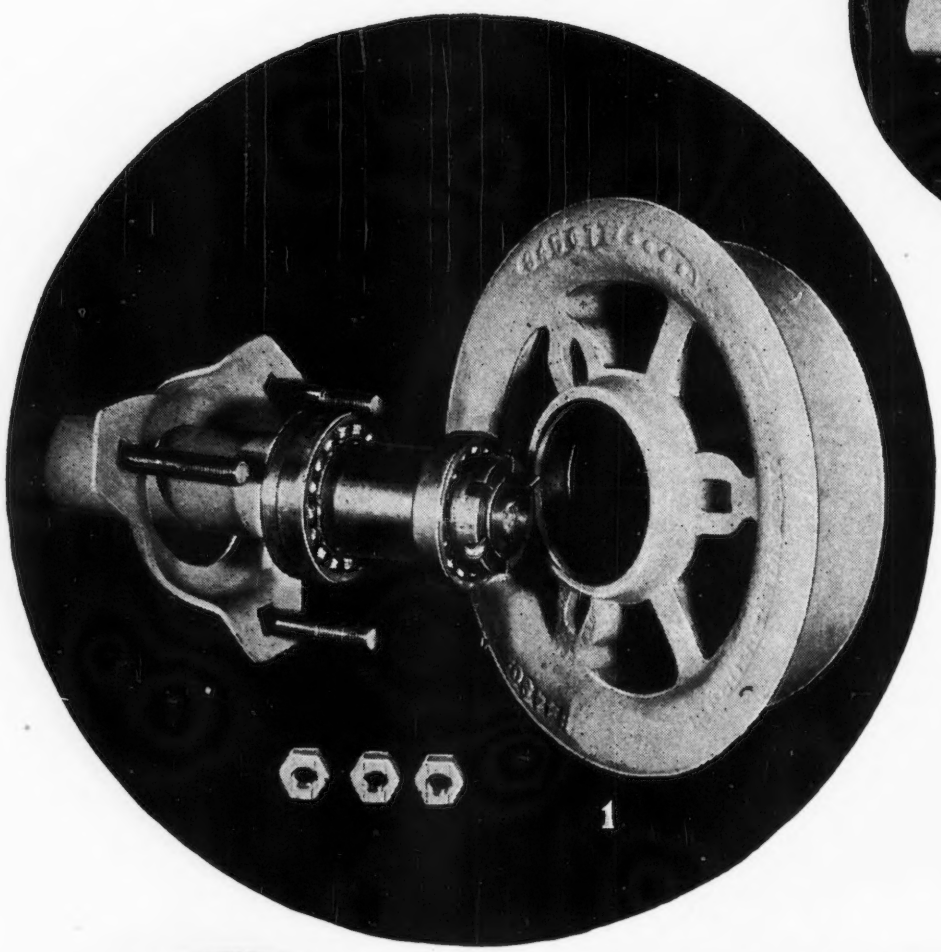

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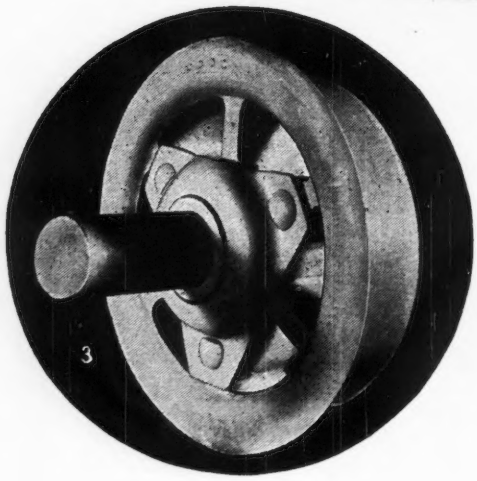

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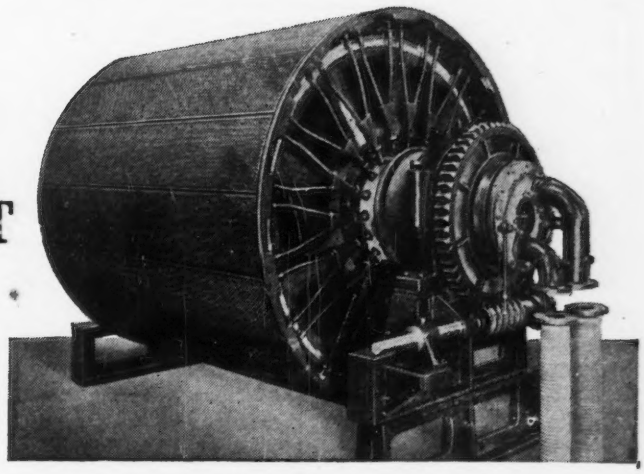

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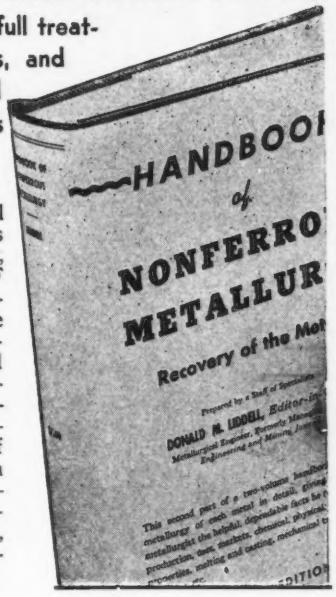

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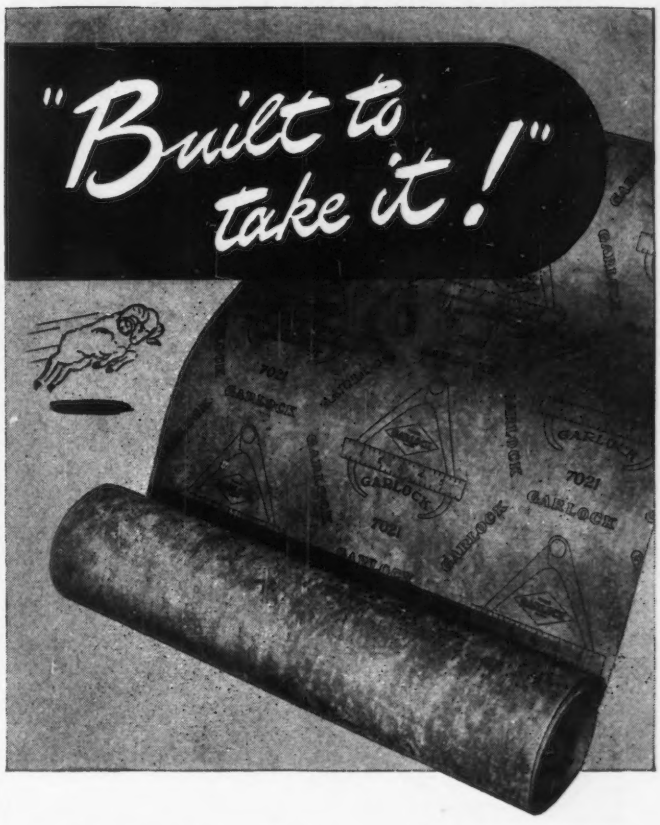

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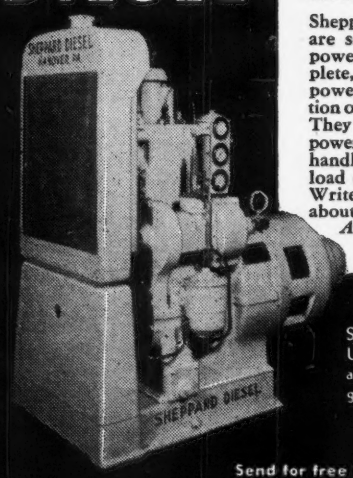

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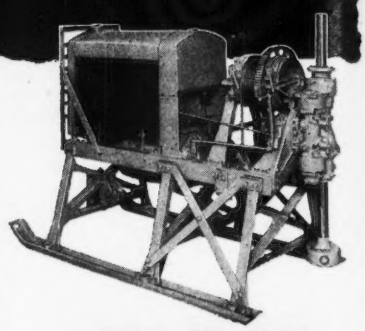

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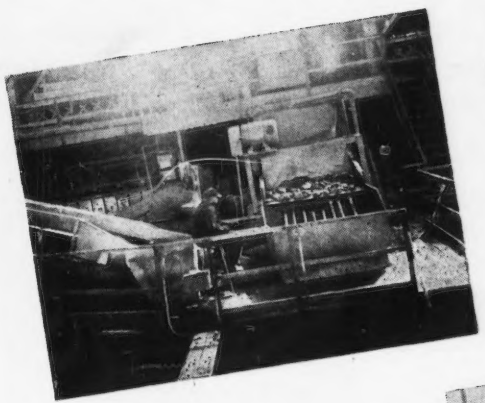

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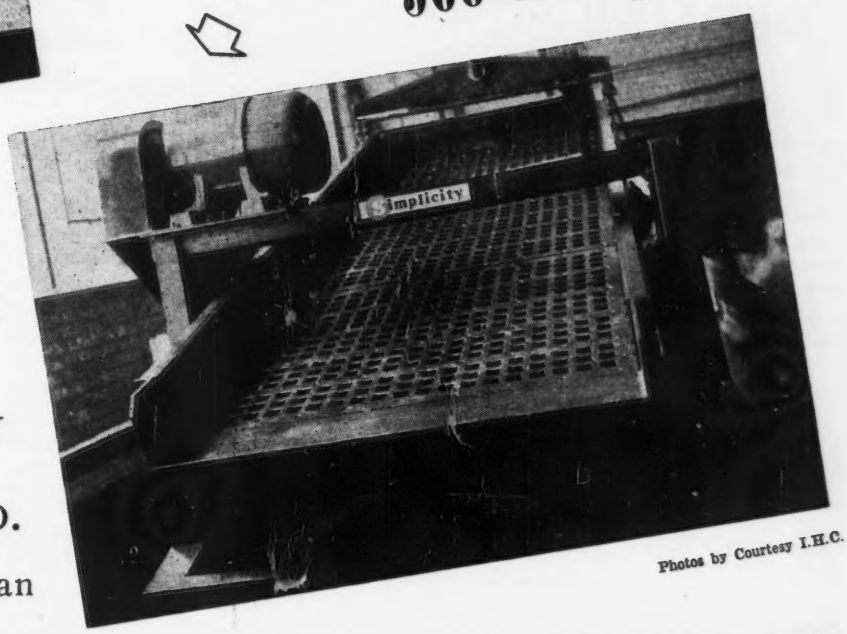

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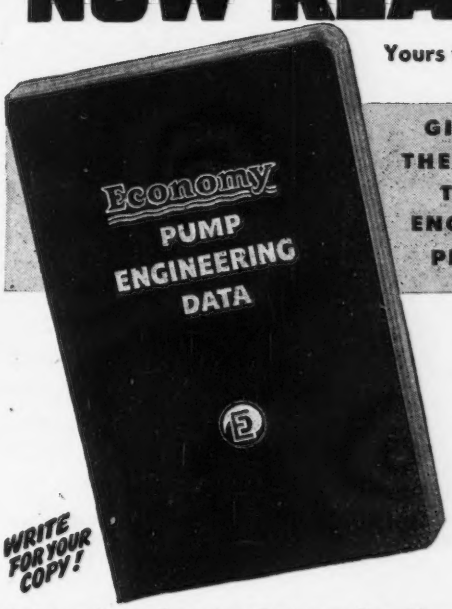

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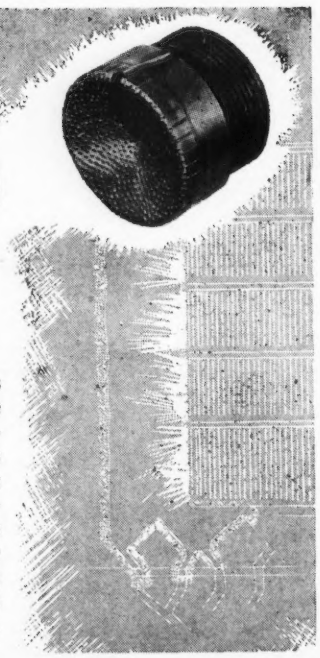

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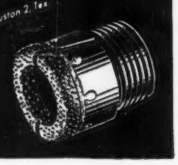

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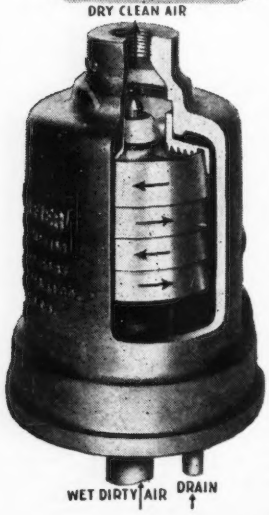

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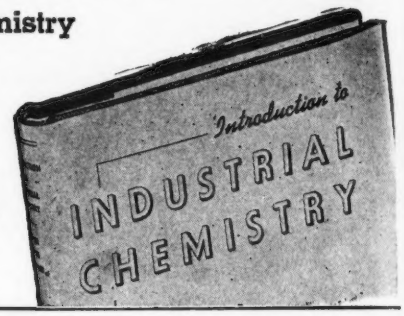

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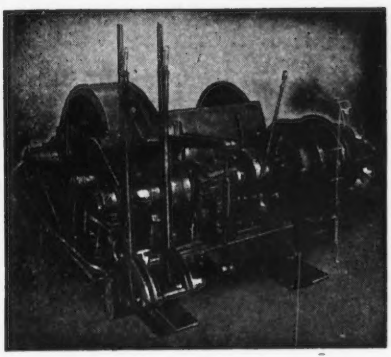

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1—2½" Pacific, 6-Stage
1—2½"x2" Byron-Jackson, 2-Stage
1—3" Fairbanks-Morse, 2-Stage
1—3" Worthington, 2-Stage
1—3" Hill, 3-Stage
2—3" United, 5-Stage
5—3" United, 6-Stage
2—3" Union, 6-Stage
1—3"x2½" Buffalo, 4-Stage
1—4" Platt Iron Works, 2-Stage
2—4"x3" Allis-Chalmers, 4-Stage
1—4"x3" Buffalo, 4-Stage
1—5" Fairbanks-Morse, 2-Stage
1—5"x4" Cameron, 4-Stage
2—6" Manistee, 8-Stage
2—6" Worthington, 6-Stage
4—6" Worthington, 3-Stage

ELECTRIC HOISTS

1— 5-HP Single Drum—Band Brakes
1— 10-HP Single Drum—Friction
1— 15-HP Single Drum—Morse Bros.
1— 20-HP-Single Drum—Vulcan
1— 20-HP Single Drum—H & B
1— 30-HP Double Drum—English Iron Works
2— 35-HP Single Drum—Steel Frame
1— 50-HP Single Drum—West Coast
1— 75-HP Double Drum—Gates
1— 75-HP Double Drum—Vulcan
1— 80-HP Single Drum—Ottumwa
1—100 HP Single Drum—H & B
1—100-HP Single Drum—Ottumwa
1—150-HP Single Drum—Ottumwa
2—200-HP Single Drum—Ottumwa
1—300-HP Double Drum—Ottumwa

CONCENTRATING TABLES

21—No. 6 Wilfley
12—No. 11-D Wilfley
12—Deister Plat-O, Right Hand
17—Deister Plat-O, Left Hand

FILTERS

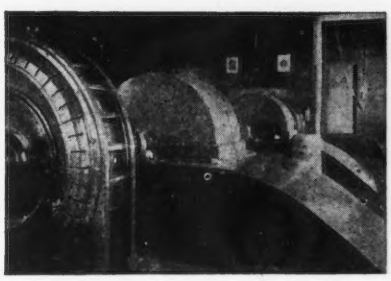
1—4'x6' DECO Drum Filter
1—8'6" 4-disc American with vacuum machinery
1—8'x10' Continuous Oliver Drum Filter with oscillating agitator
1—11½'x14' Continuous Oliver Drum Filter with oscillating agitator

BATTERY LOCOMOTIVES

1—3-Ton Whitcomb
1—3½-Ton Jeffrey
1—3½-Ton Atlas
2—5-Ton Mancha
1—7-Ton Mancha
2—8-Ton Atlas

BALL AND TUBE MILLS

1—30"x24" Morse Batch Mill
1—4'6"x13' El Paso Tube Mill
1—5'x7' Batch Ball-Tube Mill
1—7'x6' Allis-Chalmers Ball Mill
1—8'x22" Hardinge Type A Mill
1—8'x36" Hardinge Ball Mill



COMPLETE HYDRO-ELECTRIC POWER PLANT

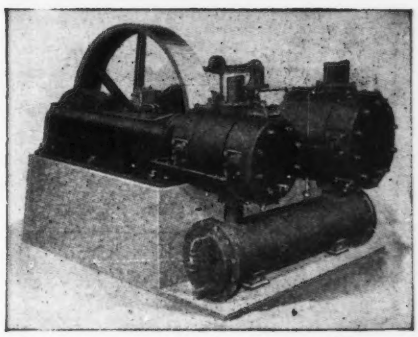
Total Capacity 900 KW
Consisting of 2—450 KW General Electric Generators with DeRemer-Box Double Water Wheels, Governors, Exciters, Switchboard, Building, Crane and Pipeline

TROLLEY LOCOMOTIVES

1—3-Ton Jeffrey—250 Volts
1—3½-Ton Baldwin—500 Volts
2—4-Ton Jeffrey—250 Volts
2—6½-Ton G.E.—500 Volts
2—6½-Ton G.E.—250 Volts

1—No. 250 Denver Unit Cell (New) with motor and drive.
10—Ruth, Practically New, Flotation Cells. Each with 3 HP Motors and V-Belt drives.

Write for New Stock List No. 441



AIR COMPRESSORS—PORTABLE

1— 90 CFM Gardner-Rix
1—120 CFM Schramm
1—160 CFM Worthington
1—172 CFM Rix
2—220 CFM Sullivan
1—220 CFM Chicago-Pneumatic
2—240 CFM Worthington
1—310 CFM Ingersoll-Rand
1—310 CFM Sullivan
1—320 CFM National
1—330 CFM National

AIR COMPRESSORS—STATIONARY —BELT DRIVEN

1—138 CFM Gardner-Denver, Single Stage
1—179 CFM Ingersoll-Rand, Single Stage
1—235 CFM Bury, Single Stage
1—310 CFM Ingersoll-Rand, Single Stage
1—342 CFM Blaisdell, Two Stage
2—447 CFM Ingersoll-Rand, Two Statge
1—487 CFM Bury, Two Stage
1—513 CFM Ingersoll-Rand, Two Stage
1—528 CFM Ingersoll-Randy, Single Stage
1—537 CFM Sullivan, Two Stage
1—637 CFM Sullivan, Two Stage
1—693 CFM Worthington, Single Stage
1—800 CFM Ingersoll-Rand, Two Stage
1—888 CFM Ingersoll-Rand, Two Stage

JAW CRUSHERS

2—4½"x6" Dodge Type Crushers
1—5"x12" Sturtevant Roll Type
1—7"x10" McFarlane, Blake Type
1—8"x36" Universal
2—9"x14" Universal
1—9"x15" McFarlane Blake
1—9"x18" Rogers, Blake Type
1—10"x16" Rogers, Force Feed Type
1—10"x20 Diamond Iron Works, Type E
1—10"x30" Good Roads Machinery Company
1—13"x30" Farrel Blake
1—36"x42" Traylor Bulldog

CRUSHING ROLLS

1—27""x14" McFarlane
2—27"x14" Walker
4—36"x16" McFarlane Rolls
2—40"x16" Colorado Iron Works
1—54"x20" Garfield

STEAM LOCOMOTIVES

1—18-Ton Davenport, Saddle Tank, 36" Gauge
1—18-Ton Davenport, Saddle Tank, Standard Gauge
3—50-Ton Brooks, 36" Gauge
2—50-Ton Baldwin, Standard Gauge

REBUILDERS OF MINING AND CONCENTRATING MACHINERY SINCE 1898

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U.S.A. CABLE "MORSE"

DEPENDABLE RECONDITIONED MACHINERY ... MINING ELECTRICAL INDUSTRIAL MILLING

GENERAL OFFICE AND PLANT 2900 BROADWAY, DENVER, COLORADO

BRANCH OFFICE 1775 BROADWAY, NEW YORK CITY

REBUILT MINING AND MILLING EQUIPMENT
GUARANTEED

AIR COMPRESSORS
1—445 Cu. ft. I.R. Imp. Type 10, with 75 H.P. Motor.
1—160 Cu. ft. Chicago-Pneumatic Portable on Steel Wheels.
1—17x10x14 I.R. Imp. 10, with 100 H.P. Motor.
1—14x7½x12 I.R. Imp. 10, without Motor.
1—8½x4¾x5 Class PB4, Chicago-Pneumatic Semi-Portable, 277 Cu. ft. on Steel Skids, V-Belted to a Mercury Ford Power Unit.

BALL & ROD MILLS
1—6'x10' Stearns-Roger Ball Mill.
1—30"x3' Baker Regrind Ball Mill.
1—4'x9' Denv. Eng. Wks. Rod Mill

CLASSIFIERS
1—18"x12' Dorr Simplex, Motorized.
1—3'x18' Dorr Simplex.
1—45" Akins Low Weir.
1—45" Akins High Weir, with Motor.

CONCENTRATING TABLES
3—No. 6 Wilfleys, V-Belted to Motors.
3—No. 6 Wilfleys, T&L Pulley Drive.
2—Plat-O Tables, T&L Pulley Drives.

CONVEYORS
1—30" Apron Conveyor, 21' Centers.
1—24" Belt Conveyor, 30' Centers, with 5 H.P. A.C. Motor.
1—14" Belt Conveyor, 20' Centers, with Gear Motor.
1—42" Belt Conveyor, 30' Centers.
1—36" Picking Conveyor, 20' Centers.

MINE LAMPS
1—Hobart Lamp Generator, complete with 150 Portable Lamp Equipment Mine Lamps and Charging Racks.

FLOTATION MACHINES
2—6 Cell No. 21 Denver, Sub-A, Rubber Lined, Motorized.

TRANSFORMERS
3—200 KVA Allis-Chalmers, 13200-240/480.
3—100 KVA West., 13800-460/230/115.
3— 75 KVA G.E., 13200-2300/400Y (New)
3— 50 KVA G.E., 13200-12000-230/460.
3— 50 KVA G.E., 13200/2300.
1— 10 KVA Gregory, 440-110/220.
1— 7½ KVA G.E., 1150-2300-115/230.
1— 5 KVA West., 440-110/220.
1— 3 KVA G.E., 550-110/220.

HOISTS—AIR
1—1500 lb. Leadville Tugger.
1—2000 lb. Sullivan Slusher.

HOISTS—ELECTRIC
1—200 H.P. Double Drum Shaft Hoist, with Motor and Mine Cages.
1—52 H.P. Converted Hoist, with Motor.
1—25 H.P. H&B Converted Hoist, with Motor.
1—15 H.P. Ottumwa, with Motor.
1—7½ H.P. Vulcan, with Motor.

LOCOMOTIVES
1—8 Ton Jeffrey Trolley Locomotive, 250 Volts DC.
1—6 Ton Jeffrey Trolley Locomotive, 250 Volts DC.
1—3 Ton Atlas Battery Locomotive, 24" Ga., with 80 Cell C-7 Edison Batteries & Charger.

RAILS
150—Tons 20# Rail.
75—Tons 30# Rail.
40—Tons 40# Rail.
10—Tons 85# Rail.
Plate Frogs & Switches, 12# to 50#.

Write for New Stock List

FLORENCE MACHINERY & SUPPLY COMPANY
904 Equitable Building, Denver 2, Colorado
Yards: Denver & Florence

SPECIALS

1—7'x48" Hardinge Mill — with motor.
1—6'x16" Hardinge Mill — with motor.
1—5'x18" Allis Chalmers Tube Mill —with motor.
1—Set Davis Crushing Rolls, 14" x27".
1—18"x36" Universal Jaw Crusher.
4—30' dia.x5' high Steel Thickeners —with mechanism.
1—50,000 gal. Tower Steel Water Tank with 32' Steel Tower — hemisphere bottom.

WE BUY

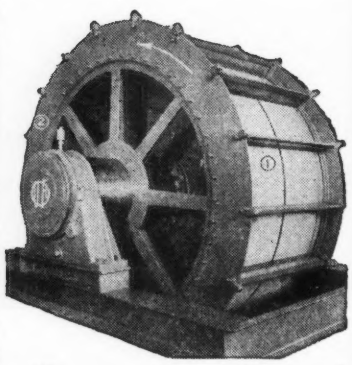
Complete Mining, Milling and Industrial Plants or any part thereof.

1—Eimco-Finlay Loader #11.
4—Campbell and Kelley 4" Sand Pumps.
Pumps—Centrifugal and Reciprocating.
25—Mine cars, all types.
2—Electric Welders.
30—Skilsaws.
50—Electric Drills.
20—DeWalt Saws.
20—"Comet" Saws.
10—Electric Light Plants.
20—Gasoline Driven Centrifugal Jaeger self-priming Pumps, 1½" to 6".
1—#6 Northwest shovel and dragline, 1½ yds.
1—#80 Northwest shovel and dragline, 1½ yds.
1—#37-E Bucyrus-Erie shovel, 1½ yds.
1—24" gauge Westinghouse electric storage battery locomotive, 6 tons.
1—1 yd. capacity Bay City crane 60 ft. boom.
1—Chicago pneumatic portable diesel compressor 315 c.f.m.
2—105 ft. IP portable compressors.
1—210 ft. Worthington portable compressor.
Contractors' Equipment—Caterpillars, Carry-Alls, Shovels, Drag Lines.

Mining and Milling Equipment

Factory Representatives
Osgood Company—General Excavator Co.
Shovels, Draglines, Cranes

HYMAN-MICHAELS COMPANY
United Commercial Division
2200 Jerrold Ave., San Francisco 24



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OLIVER HOPPER

DEWATERERS

TOP FEED—ACID PROOF CONSTR. 8'0" Dia. x 6'0" Face. 150 sq. ft. area. Complete with vari-speed drive and supporting frame. Write for full description and drawings. Real bargain.

OPERATION:

The feed to the Filter is begun at about the point indicated at #1. The Feed results in a moderately uniform mass of material in the bottom of the hopper as the feed continues for a short time and then is maintained under vacuum until reaching approximately the horizontal point marked #2 on the opposite side of the filter drum.

SURPLUS EQUIPMENT NEEDED
A single piece or a complete plant. Send us your list.

Write for Our Complete List

ORELAND EQUIPMENT CO.
P. O. BOX "E", ORELAND, PENNA.

LIQUIDATION

(near Pittsburgh, Pa.)

2—6'x60' Rotary Kilns.
2—Jaw Crushers, 10"x20", 9"x15".
1—Denver Sub-A 6 Cell Flotation Machine.
1—Raymond 5 Roll Low Side Mill, motor driven, with fan and accessories.
4—Rotary Dryers, 6'xx45', 4'x16', 3'x16'.
1—16" Troughing Belt Conveyor, 180' centers.
1—FEINC 5'x4' Rotary Continuous Filter.
1—6'American 2 Disc Rotary Filter.
3—Bucket Elevators, 30' to 45' centers.
20—Centrifugal Pumps, 2" to 8".
30—Steel Tanks, 10'x10' to 22'x15'.
30—Agitator Headers and Dorr Thickeners for above tanks.
1—Diester-Concentrator Co. Leahy Double Surface Screen.
200 H.P. of Motors, 10 to 150 HP., 3/60/440 volt with starters.
Large Quantity of Structural Steel; 50 tons of Steel Pipe, 2" to 8"; 20 tons of Steel Shafting, etc.

6—Oliver Top Feed 8'x6' Continuous Dewaterers. NEW.
3—Tyler Hummer and Rotex Screens.
3—Rotary Kilns, 9'x70', 8'x100'.
2—Hardinge Mills, 4½'x16", 4½'x24".

Priced Right for Quick Sale. WIRE, PHONE, WRITE for full details.

BRILL EQUIPMENT CO.
225 West 34th St., New York 1, N. Y.

NEW and REBUILT
STORAGE BATTERY
LOCOMOTIVES
1½ to 10 Ton—18" to 56" Track Gauge
GREENSBURG MACHINE CO.
Greensburg, Penna.

FOR SALE
1—ALLIS-CHALMERS—900 H.P. double drum elec. mine hoist—Late Type—Condition A1.
1—HENDRIE & BOLTHOFF—100 H.P. Single Drum elec. mine hoist.
1—FLORY—75 H.P. 3 Drum Contractors Hoist.
1—GARDNER DENVER—445 Cu. Ft. Air Compressor 2 Stage—Type WBH 4008.
1—INGERSOLL RAND—420 Cu. Ft. Air Compressor 2 Stage—Gas Driven.
1—WAUKESHA-HESSELMAN—113 H.P. Model WBFH Diesel Engine.
1—TRAYLOR—"Bull-Dog" No. 10 Fin. Gyratory Crusher.
1—LINK-BELT—36"x60" Double Roll—Coal Crusher—Segmented Teeth.
2—TRAYLOR—FB4—2 Deck Electric Vibrating Screens—Deck Size 47"x88".

ELECTRIC CABLE
10,000 Ft. #2 3 Cond. Interlocking Steel Armored 1000 Volt—Pure Gum Rubber insulation.
10,000 Ft. #2/0 3 Cond. Lead Sheathed Steel Taped Armored 5000 Volt.
3,000 Ft. #6 3 Cond. Steel Taped Armored 2300 Volt.
700 FT. #6 3 Cond. 16000 Volt.
18,000 Ft. 18" I.D. Random Lengths DOUGLAS FUR—Wood Pipe wrapped w/ #4 Steel Wire—Tarred—Couplings.

WESTERN SALVAGE & SUPPLY
220 West So. Temple Salt Lake City, Utah

AIR COMPRESSORS:
(7) Beam 46 ft., 66 ft., 300 ft., 600 & 1,000 ft.
(12) Belted,, 360, 676, 870, 1,200 ft.
(6) Electric, 1,300 1,500, 1,722, 2,000, 5,000 ft.
(14) Gasoline, 110, 160, 220, 310 & 370 ft.
6 Diesel 105, 315, 420, 603, 1,000 & 1,500 ft.
STORAGE BATTERY LOCOMOTIVES:
4—4-ton Goodman, 36 Ga.
3—5-ton G. E., 36 Ga.
4—6-ton Goodman, 36 Ga.
5—8-ton Baldwin Westgh., 36 Ga.
TROLLEY LOCOMOTIVES:
3-3-ton & 2—4-ton Goodman, 36 Ga.
5—30-ton, 50-ton & 70-ton Std. Ga.
DIESEL & GAS LOCOMOTIVES:
3—Whitcomb 12- & 15-ton Std. Ga. Gas.
44-ton G. E. Std. Ga. Diesel.
6—Plymouth Gas 6- & 12-ton, 36 Ga.
8-ton Plymouth Std. Ga. Gas.
R. R. CARS:
150—8,000- & 10,000-gal. Tank Cars.
100—40-ton Box Cars.
50—50-ton Gondolas.
150 Dump Cars, 2 to 30 yd.
RUBBER CONVEYOR BELTS:
1,000' 60", 600' 30", 300' 20", 1,600' 42", 1,750' 48", 1,150' 36", 1,200' 24", 900, 18", 600' 16", 350' 14".
CONVEYOR PARTS:
Idlers, Head & Tail Pulleys, Steel Frames, Tripper, etc., 14 in., 60 in. Large stock in Jersey.
VIBRATING SCREENS:
7—Hummer 3x6m, 4x5, & 4x8.
5—Link Belt, 4x8, 4x10, & 5x12.
TRAMWAY:
2,300 ft. 80/100 yds. per hr.
ROTARY KILNS:
5'x24', 7'x40', 6'x60', 7'6"x125', 8'x160'.
ROTARY DRYERS: Direct Heat:
Double Shell: 5'x26', 5'x30', 5'6"x60', 80"x45'.
Single Shell: 5'x30, 60x40, 6x50, 6x60, 7x60, 8x120.
Indirect Heat: 24'x20', 5x30, 6x40.
STEEL TANKS:
16—8,000-10,000 gal. Car Tanks.
26—5,000, 6,000, 8,000, 15,000, 25,000 & 30,000 gal. cap. Heavy Cyl.
SHOVELS—DRAGLINES—CRANES:
2-48B 2 yds. Diesel Shovel-Draglines.
2 Yd. 42B E Steam Shovel.
6 Yd. Bucyrus 200 B Stripper Shovel.
4 Yd. Marion Electric Shovel.
2 Yd. Marion Electric Shovel.
3—Monighan Diesel Dragline 3W & 4W.
4—1 & 1 Yd. Bucyrus Elec. Shovels.
3—20 & 25 ton Locomotive Cranes.
MINE LOADERS—SHOVELS:
8—Conway Models, 20, 30, 50, 60 & 75.
1 Yd. Lorain Model 57 Elec. Shovel.
3—Gardner Denver GD9H.
3—Elmco Findley Model 12B & 21.
2 Nordberg Car Loaders.
1 Sullivan HL3 Car Loader.
FINE REDUCTION CRUSHERS:
2—4¼ ft. Symons Cone.
No. 1 Stunteven Ring Roll Mill.
7—Symons 2, 3, 4 & 5 ft. & 7 ft.
11—Kennedy S19, 25, 37 & 49.
7 In. & 10 In. Newhouse.
10 In. Allis-Chalmers McCully
2—Traylor 4½x27 Bulldog.
5 In., 6 In., 8 In., 20 In. Traylor.
28 In. Traylor TY.
FINE JAW CRUSHERS:
4x46, 6x20, 8x12, 3x36, 9x16, 9x26, 10x24, 10x30, 10x36, 1042, 13x30, 15x36, 15x38, 10x42.
COARSE JAW CRUSHERS:
5x10, 6x12, 7x9, 7x10, 10x12, 9x16, 9x18, 10x20, 12x18, 1220, 12x22, 12x24, 12x26, 14x24, 13x10, 15x30, 15x36, 18x32, 18x36, 24x36, 30x36, 36x48, 42x48, 56x84, 60x84.
BALL MILLS:
5'x22' Tube Mill Flint Lining.
6'x6' Herman Ball Mill.
3'x36" Hardinge Ball Mill.
8'x30" Hardinge Type A Mill.
5½'x20' Smidth Tube Mill.
4'x12' Smidth Tube Mill.
6'x12' Marcy Rod Mill.
10'x48" Hardinge Ball Mill with 300 H.P., 2,300 V. Motor.

Mine Equipment Bought & Sold
R. C. STANHOPE, INC.
60 East 42nd St., New York 17, N. Y.

FOR IMMEDIATE DELIVERY OF RUBBER PRODUCTS

Conveyor Belting...Transmission Belting...Elevator Belting...Fire, Water, Air, Steam, Suction or Welding Hose, etc.

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CARLYLE
THE RUBBER HEADQUARTERS

CARLYLE RUBBER PRODUCTS ARE NEW, GUARANTEED & LOW PRICED

CONVEYOR BELTING

ABRASIVE RESISTANT COVERS

Width	Ply	Top-Bottom	Covers
48"	8	1/8"	1/16"
42"	5	1/8"	1/16"
36"	6	1/8"	1/16"
30"	6	1/8"	1/16"
30"	5	1/8"	1/16"
24"	5	1/8"	1/32"
24"	4	1/8"	1/32"
20"	5	1/8"	1/32"
20"	4	1/8"	1/32"
18"	4	1/8"	1/32"
16"	4	1/8"	1/32"
14"	4	1/16"	1/32"
12"	4	1/16"	1/32"

Inquire For Prices - Mention Size and Lengths

TRANSMISSION BELTING

HEAVY-DUTY FRICTION SURFACE

Width	Ply	Width	Ply	Width	Ply
18"	6	10"	6	6"	5
16"	6	10"	5	5"	5
14"	6	8"	6	4"	5
12"	6	8"	5	4"	4
12"	5	6"	6	3"	4

Inquire For Prices - Mention Size and Lengths

ENDLESS "V" BELTS

"A" WIDTH All Sizes | "D" WIDTH All Sizes
"B" WIDTH All Sizes | "E" WIDTH All Sizes
"C" WIDTH All Sizes | Sold in Matched Sets

Inquire For Prices - Mention Size and Lengths

PROTECT THAT PLANT
FIRE HOSE

APPROVED SPECIFICATION HOSE
EACH LENGTH WITH COUPLINGS ATTACHED

Size	Length	Per Length
2½"	50 feet	$28.00
	25 "	16.00
2"	50 "	23.00
	25 "	13.00
1½"	50 "	20.00
	25 "	11.00

Specify Thread On Couplings

SPECIAL OFFER . . . HEAVY DUTY
RUBBER HOSE

WATER HOSE
Each Length with Couplings Attached

I.D. Size	Length	per Length
¾"	25 feet	$4.25
1"	50 "	8.00
	25 "	6.25
1¼"	50 "	12.00
	25 "	7.50
	35 "	10.50
	40 "	12.00
1½"	50 "	15.00
	25 "	10.00
	35 "	14.00
	50 "	20.00

AIR HOSE

I.D. Size	Length	per Length	Couplings
½"	25 feet	$5.00	$1.50 Pair
	50 "	10.00	1.50 "
¾"	25 "	6.25	2.50 "
	50 "	12.50	2.50 "
1"	25 "	10.00	3.50 "
	50 "	20.00	3.50 "

LARGER SIZES ALSO AVAILABLE
All Prices—Net—F.O.B. New York

CARLYLE RUBBER CO., INC.
62-66 PARK PLACE NEW YORK, N. Y.

DSP INC. ORGANIZATIONS

MINES, MILLS, RAILROADS, PLANTS OF ALL KINDS

BOUGHT — SOLD AND LIQUIDATED

Good Used
MINING & MILLING EQUIPMENT
FOR SALE

DULIEN STEEL PRODUCTS, INC. OF WASHINGTON
1066 Western Ave. Seattle 4, Wash. P. O. Box 1945 Butte, Mont.

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4 miles 36" used riveted wrought iron pipe, $\frac{5}{16}$" thickness, approx. 28' lengths, plain end, make excellent water line.

JOS. GREENSPON'S SON PIPE CORP.
Natl. Stock Yds. St. Clair Co., Ill.

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26 AND 60 IN. CONVEYOR BELTS
6600 Ft., New, 26 In., 5 Ply.
2000 Ft., Like New, 60 In., 10 Ply.
IMMEDIATE SHIPMENT.

R. C. STANHOPE, INC.
60 East 42nd St. New York 17, N. Y.

1—2-Unit, 87-Ton Westinghouse Diesel Electric Locomotive. Equipped with two 300 H.P. Westinghouse engines. Can be operated as 1 or 2 units.

2—44-Ton Westinghouse Electric 600 V.D.C. Excellent Condition. Just Overhauled.

IRON & STEEL PRODUCTS, INC.
40 years' experience
13476 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

OVERHEAD CRANES

½ -Ton "American" 17' Span
1-Ton Curtis 24' Span
1½-Ton P&H 28' & 34' Span
2-Ton "Detroit" 28' Span
2-Ton Shephard Niles 18' Span
3-Ton Euclid 38' 8¾" Span
5-Ton Shephard Niles 40' Span
5-Ton Shaw 82' Span
5-Ton "American" 70' Span
5-Ton American 47' 5" Span
5-Ton Manning Maxwell Moore 31' Span
5-Ton Case Gilbert 44' 9¾" Span
5-Ton P&H 44' 9¾" Span
5-Ton Champion 44' 9¾" Span
5-Ton Bedford 34' Span
6-Ton P&H 78' Span
6-7-Ton Milwaukee 70' Span
6-Ton "American" 77' Span
7½-Ton P&H 30' 6" Span
7½-Ton Lakeside 100' Span
7½-Ton Bucyrus-Erie 70' Span
10-Ton P&H 60' Span
10-Ton Milwaukee 58' 9" Span
10-Ton Morgan 39' 5" Span
10-Ton Alliance 58' 9" Span
10-Ton Erie 80' Span
10-Ton Emsco 80' Span
10-Ton P&H 78' Span
10-Ton Bedford 78' Span
10-Ton "American" 27' Span
15-Ton Whiting 57' 3" Span
15-Ton Leonard-Burke 74' 9" Span
15-Ton Shaw 77' Span
15-Ton Shaw 82' Span
15-Ton Whiting 74' 8" Span
15-Ton Niles 32' Span
15-Ton Chesapeake 5' 6" Span
15-Ton Alliance 35' Span
15-Ton Northern 53' Span
20-Ton Alliance 77' Span
20-Ton P&H 51' 4" Span
20-Ton Shephard Niles 44' 9" Span
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RESIDENT MINE Geologist large company, Bolivian Andes, standard three-year contract. Systematic mapping, supervision diamond drilling, initiate development and exploration. Preferably man with underground experience. State age, marital status, experience, salary. P. 665, Engineering & Mining Journal, 330 W. 42nd St., New York 18, N. Y.

WANTED FOR Nicaragua. Gold mining company requires four shift bosses; salary $250.00 monthly, plus board and lodging; also two shaft sinking foremen at $300.00, plus board and lodging. Must have had previous experience in position desired. Spanish very desirable but not essential. Travelling expenses paid. Write fully giving age, training and experience. Company also requires experienced diamond drill operator, salary open. P. 673, Engineering & Mining Journal, 330 W. 42nd St., New York 18, N. Y.

POSITIONS VACANT

WANTED: JUNIOR Engineer graduate mining or civil preferred. General engineering work in open pit phosphate mining. Washing and processing plant.—Tennessee. Give full qualifications and state salary expected. P. 654, Engineering & Mining Journal, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

ENGINEER, 45, seventeen years' experience design and construction and six years actual operating experience copper flotation and smelting, lead-zinc flotation, magnetic iron concentrating and sintering, also housing and malaria control, USA, South America and Africa. Desires assignment in charge design and construction. Single status, speak Spanish, available on reasonable notice. PW 641, Engineering & Mining Journal, 330 W. 42nd St., New York 18, N. Y.

(Continued on opposite page)

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P647, Engineering and Mining Journal, 330 West 42nd St., New York 18, N. Y.

SEARCHLIGHT SECTION

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FOR LEASE: New mineral deposit 200 ft wide, 700 ft. long gold, silver, copper. Chas. Krutsinger, 444 Lincoln, Loveland, Colorado.

WANTED

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Salary £839.2.3. (Aust.) to £893.2.3. (Aust.) p.a. according to qualifications and experience, and subject to deductions under the Superannuation Act. Actual first-class travelling expenses of appointee and his family to Sydney will be allowed.

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Applications must reach the Secretary, Public Service Board, 19 O'Connel Street, Sydney, New South Wales, Australia, by 31st December, 1945.

POSITIONS WANTED

MINE MANAGER, desires connection U. S. or Canada, 22 years' experience—mining and milling gold, silver, lead, zinc and tungsten ores, both open-pit and underground, reputation low cost operation through efficiency and mechanization. Available August 1st. Last connection 8 years. Draft exempt. PW. 640, Engineering & Mining Journal, 68 Post St., San Francisco 24, Cal.

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ELECTRICAL-MECHANICAL superintendent or foreman. Many years experience dredging, mines and power stations. Age 47, married, single status. Speak fluent Spanish. Foreign only. PW 669, Engineering & Mining Journal, 68 Post St., San Francisco 24, Cal.

MINE MANAGER of operating gold mine, or superintendent of gold mill. Years of experience underground and surface as miner, engineer, assayer and millman. At present mill superintendent of four hundred ton plant. B.Sc. from first class technical school. Available on one months notice. PW 670, Engineering & Mining Journal, 330 W. 42nd St., New York 18, N. Y.

MINING ENGINEER: M.I.C.M. and graduate. Age 38, 14 years' experience—diamond drilling, shaft sinking, lateral development and production. Property examination. Presently employed. Will handle American interests in Canada. PW 682, Engineering & Mining Journal, 330 W. 42nd St., New York 18, N. Y.

GRADUATE MINERAL dresser. Married, 28. Discharged Army Captain. Six months' experience milling molybdenite, ore testing and chem. lab. Desire domestic position. PW 674, Engineering & Mining Journal, 520 N. Michigan Ave., Chicago 11, Ill.

MINE AND Railroad Engineer—Eight years of diversified experience in mining and railroad engineering. Latin American experience. Speaks Spanish. Age 29. Desires Latin American location. Available now. PW 675, Engineering & Mining Journal, 520 N. Michigan

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